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PRICE 20 CENTS

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APRIL 20, 1946

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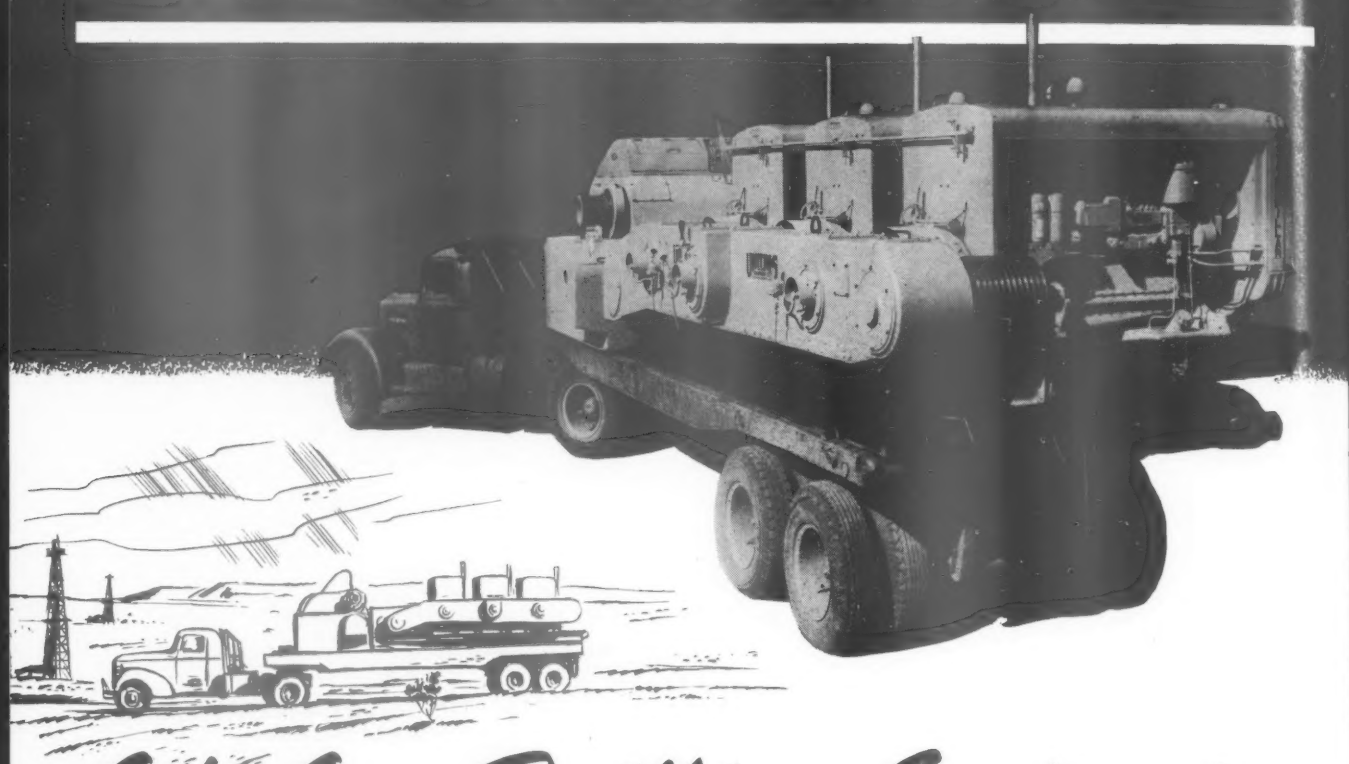

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211 S. CHEYENNE AVE., TULSA 1, OKLAHOMA

FOUNDED IN 1910 BY PATRICK C. BOYLE

Subscription rate to the petroleum industry, United States and foreign, 1 year, $3.00. Single copies, 20 cents. Back copies, when over a year old, 50 cents. Note: Payments from outside the U. S. A. may be in the form of an international money order or check on a U. S. A. bank. Entered as second-class mail matter at Tulsa, Okla., under Act of March 3, 1879.

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Vol. 44, No. 50 April 20, 1946

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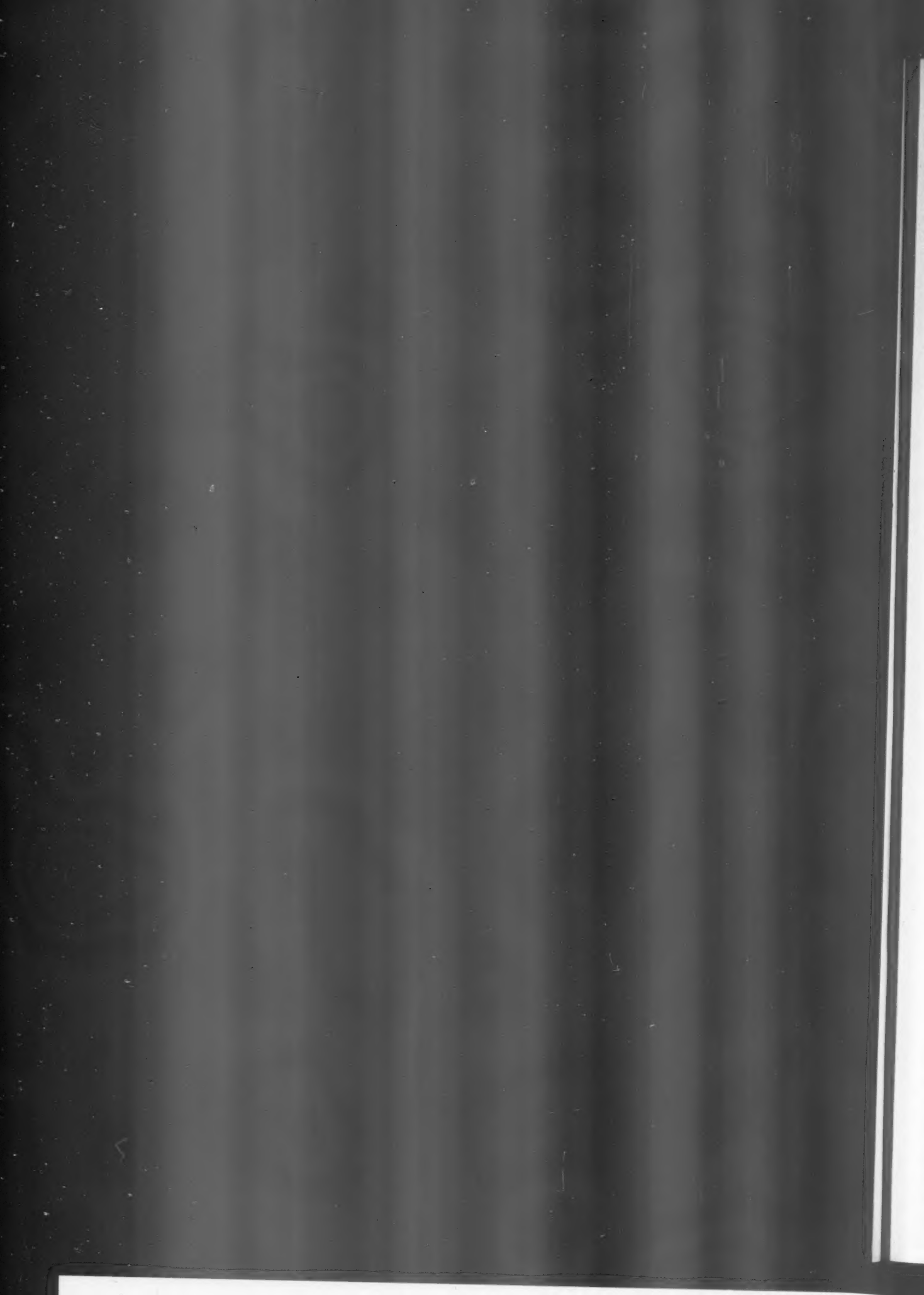


THE OIL AND GAS JOURNAL

Conservation and Price

As we listened to the prepared papers and the open-forum sessions at the Interstate Oil Compact Commission meeting last week we fell to wondering how far members could go and to what end in discussing conservation practices without encroaching on the supposedly taboo subject of price. Certainly nothing happened at the Tulsa meeting to which the most captious of the Washington critics could object. As one observer opined, the members and guests "leaned over backwards" in avoiding the subject.

The compact under which the commission operates makes clear that members working together in the solution of common problems cannot enter into agreements involving prices for crude oil and its products. To this provision there can be no objection on the part of the state regulatory bodies or the oil industry with its foundation of competitive operations.

In recent months the state bodies have inherited all the production problems of the transition period from war to peace. They again have the sole legal responsibility of enforcing conservation regulations and adopting additional rules on the basis of new techniques. At the same time they are asked to supply an unbalanced market, the prices of which are established by a hangover war agency which is determined to perpetuate itself.

These state agencies can't evaluate product consumption until it is defined in terms of crude oil. At present and for several months there has been a heavy demand for intermediate and residual products which does not conform to the normal trend which places emphasis on increased yields of light products.

A balanced operation is possible only through higher prices for the scarce products. The alternative, reflected in the operating trends of recent months, is to refine sufficient crude oil to supply the exceptional demand for the heavier products, resulting in an oversupply of gasoline.

The remedy obviously lies in a price flexibility in the future as in the past which will enable refiners to supply seasonal and extraordinary product requirements with minimum quantities of crude oil. That is conservation as it should function.

The compact representatives know this as do the members of the new economics committee which can render valuable service to the entire industry in projecting requirements. But nothing was said. The Tulsa meeting went down to the beach but kept out of the water.

Frank discussion of present unsatisfactory price conditions as a guide to individual and state operations is mandatory. We know of no reason why the conservation officials representing their states should not forcefully call this fact to the attention of OPA and the Washington administration. Their own future is one of the issues at stake.

Argentine Export Controls Lifted; All Operations to Expand

WASHINGTON. — A multimillion dollar market was open this week to American manufacturers of oil production and refining equipment as a result of the lifting of export controls on Argentina.

The action, based on the reversal of American policy following the election of Col. Juan D. Peron as president, gave a green light to at least $12,000,000 in equipment orders already reported placed by Argentine companies in the United States. In New York, a representative of YPF, Argentine Government oil administration, said the organization is prepared to spend more than $50,000,000 in the United States in the next 2 years.

Other companies operating in Argentina also are planning heavy purchases. Argentina has been cut off from normal imports since 1942, and the need for replacement equipment was described as urgent. In addition, expansion is planned in several phases of the industry. One American company alone was reported to have waiting in warehouses and earmarked for Argentine shipment approximately $7,000,000 in equipment.

Routine Announcement

The lifting of the trade restrictions came in a routine announcement of the Department of Commerce's Office of International Trade which said that general license privileges enabling exporters to ship freely are now extended to include Argentina. The State Department, through Spruille Braden, Assistant Secretary of State, continued to talk tough on the issue of Argentina's alleged pro-Nazi regime, while the Commerce Department was relaxing the controls.

Argentina was shifted from Country Group E to Country Group K. The country was thus placed in the same category as all other foreign nations except Spain, Germany, Japan, Andorra, Austria, Bulgaria, Hungary, and Rumania. As with other countries, special licenses will be required for scarce items still on the "Positive List." While including no oil equipment proper, this list of scarce items names cars, trucks, tires, paints, various industrial chemicals, structural steel, many building materials, and a number of other commodities.

A long controversy between the Commerce Department and the State Department preceded the lifting of the export controls. Commerce was under terrific pressure from exporters of oil-industry equipment and thousands of other things who had millions of dollars worth of Argentine orders in hand or in sight but who could not fill them because commerce's Office of International Trade (the old Office of Export Controls) consistently rejected all applications for export licenses.

In doing this commerce was following the State Department's policy of trying to put pressure on Argentine because of alleged fascist tendencies in its Government. Refusal to export was just one of the instruments used, but in spite of these—some say because of them—the recent Argentine election went overwhelmingly the way the State Department hoped it would not go.

Since our Argentine policy had obviously failed, commerce went to work to get the State Department to accept the economic facts of life. It was able to show that Argentina was placing orders for goods in many European countries and with some prospect of getting them filled before long. Other nations may not like the complexion or Argentine politics but they need Argentina's trade. Even Soviet Russia now maintains a trade office in Argentina and may soon resume diplomatic relations. This bore out what commerce called the folly of unilateral economic sanctions.

Full Meaning of Action

When state finally decided to send an ambassador to Argentina, commerce served notice that it was not going to continue a futile diplomatic policy at the expense of American exporters, so without fanfare it quietly dropped the restrictions.

The full meaning of the lifting of the controls was made plain by statements of representatives of various Argentine oil companies in New York. The YPF representative, Juan Benessar, chief of the concern's commission, said three new 20,000-bbl. daily capacity refineries are planned, in addition to a large lubricating oil plant and a large asphalt plant, to be located at one of the existing refineries.

YPF properties, he said, are badly in need of replacement equipment, in nearly all categories, rotary rigs, casing tubing, cementing equipment, sucker rods, pumping units, marine equipment, compressors, engines, motors, and other material. YPF has a considerable amount of equipment purchased in 1941 and now stored in New York ports. Shipment of this material will be made possible by the new Government order.

Estimates made in New York placed the amount of production equipment alone needed for Standard Oil Co. (N. J.) Argentine affiliate at $600,000. The items described as particularly in demand are wire lines, cars, trucks, casing, rock bits, pumping equipment, well surfacing units, gas compressors. Further drilling is planned on locations in all seven of the company's Argentine fields. One wildcat in San Pedro field recently was shut down because of a reported lack of pump parts.

Jersey Standard also is studying the equipment needs necessary to restore two of its refineries to prewar conditions. Replacing wornout machinery and deferred maintenance were emphasized. The Campana refinery, 50 miles north of Buenos Aires, with a rated throughput of 16,000 bbl. daily, is now down to 10,000. The Bahai Blanca refinery, on the coast 500 miles southwest of the capital, is processing 2,000 bbl. daily despite its rated capacity of 3,000 bbl.

Higher Octane Ratings

Another factor under consideration by all the refining companies involved in the likelihood of a general lifting of octane ratings in the country from 65 to 70. Private companies generally were planning to meet YPF's lead in boosting octane ratings. Additional and improved equipment for the higher-grade gasoline was viewed as necessary.

Replacement of wornout equipment was termed the major problem for still another Argentine company, Ultramar SAPA, a marketing and refining company controlled by Socony-Vacuum Oil Co., Inc., and The Texas Co. It is planning improvements to meet the competition of YPF and other interests in the expected raise of octane ratings. Refinery throughput for the company is now averaging 4,000 bbl. or more daily, as compared to 2,500 bbl. during the war. Prior to the war, the company was producing 6,500 bbl. daily.

The lack of equipment for expansion and maintenance of Argentina's oil industry appeared to be reflected at least partially in statistics showing a decline in production of the country's refineries in 1945 as compared to 1944. Throughput in 1945 totaled 3,833,423 cu. m. (217,505,649 bbl.) of crude, compared with 1944's total of 3,912,730 cu. m. (246,501,990 bbl.) Of these totals only 155,898 cu. m. (9,822,474 bbl.) were imported in 1945, compared with 155,267 cu. m. (9,782,388 bbl.) in 1944.

Thus domestic throughput in 1945 was 3,677,525 cu. m. (231,684,075 bbl.) compared with 3,757,454 cu. m. (236,719,602 bbl.) for 1944. These figures were released by the Argentine Government.

Members of the economics advisory committee of the Interstate Oil Compact. Standing: H. J. Struth, Dallas; Lynn Wolfe, Bartlesville, Okla.; R. A. Henricks, Bartlesville; James V. Brown, Washington; Stewart P. Coleman, New York; and John Boatwright, Chicago. Seated: Joseph Pogue, New York; Frederick Lott, Washington; A. J. McIntosh, New York; J. M. Sands, Bartlesville; Richard Gonzales, committee chairman, Houston; Fred Van Covern, New York; and Joseph H. Salman, New York

Compact Told of Continued High Demand for Crude Oil

by Dahl M. Duff

A CONTINUING high rate of domestic crude-oil demand, ranging between 4,400,000 and 4,500,000 bbl. daily, was forecast in Tulsa last week by the Interstate Oil Compact's economics advisory committee.

Reporting at the compact's 3-day quarterly spring meeting, the committee, composed of some of the nation's leading oil economists, gave official recognition to the fact that current demand is running about 10 per cent above the volume indicated in forecasts made late last year.

While temporary needs such as the requirements of the Navy for fuel oil and seasonal fluctuations may cause some variations from the average, the group said demand will remain near recent levels for the rest of the year. The estimate of 4,400,000 to 4,500,000 bbl. daily compares with a demand of about 4,520,000 bbl. daily in the first quarter of 1946.

The compact deferred until its next meeting in August the question of expanding its statistical section and making permanent its present experimental report which summarizes oil and gas operations throughout the United States. In other actions at the meeting the compact:

1. Referred to a subcommittee a proposal to support a permanent price differential, or "subsidy," for production obtained from stripper wells.

2. Shelved suggestions that the compact express itself against ratification of the Anglo-American oil treaty and continued control of prices of oil and its products by the Office of Price Administration. No action was taken on either of these controversial questions.

3. Decided to hold its next meeting in Michigan in August, at a date and place to be determined later.

The report of the economics advisory committee and an earlier roundtable discussion into which was injected the issue of federal price control, took major attention at the meeting. In addition, the approximately 200 state officials, industry representatives and observers heard numerous reports and several addresses. Principal speakers were Dr. Harold Vagtborg, director of the Midwest Research Institute; E. N. Kemler, head of the engineering research division, Southern Research Institute; Sam H. Jones, former Louisiana governor; and Ben Laney, Arkansas governor.

The open forum was presided over by E. H. Thompson, Texas railroad commissioner. It appeared to again illustrate the futility of divorcing economic considerations from a discussion of oil conservation.

H. B. Fell, executive vice president of the Independent Petroleum Association of America, asked that the compact protest OPA control of the

The executive committee of the compact: Hiram M. Dow, Roswell, N. M.; Sidney Latham, Dallas; Robert S. Kerr, Oklahoma governor, chairman; Sam H. Jones, Lake Charles, former Louisiana governor; and Andrew F. Schoeppel, Kansas governor

industry. He said its restrictions constituted a "half-free, half-rule of the industry and of the state regulatory bodies" and that "we must take the shackles off the industry and the regulatory bodies and permit supply and demand to function."

Thompson, though conceding OPA controls are hampering operations of the industry, declared that under his interpretation of the compact's purpose the organization had no authority to discuss the price question. This view was challenged by Warwick M. Downing, Colorado compact representative, who said the opinion of the legal committee was the compact could consider such problems.

Thompson reviewed the work of the Texas Railroad Commission in preventing waste and explained the recent action of the commission in increasing the Texas allowable was made when a study showed the addition could be granted without physical waste. "We did not consider economic waste," he said.

After Richard J. Gonzales, chairman of the economic advisory committee, delivered the report, Robert S. Kerr, Oklahoma governor and compact chairman, jokingly chided the group. He said it appeared as if the economists would make a forecast in January, revise it in the spring, again in the summer, and then give a final forecast for the year in December.

Gonzales, also chief economist for Humble Oil & Refining Co., Houston, said in the report that individual estimates of members of the committee show that refinery crude runs to stills about equal domestic crude production. Imports of crude, he added, are expected to offset approximately the exports of crude and use of crude oil as such.

First Quarter Demand

"The demand in the first quarter was . . . approximately 10 per cent above the volume generally indicated by forecasts late last year," the report said. "This difference is related to the operation of the economy at a higher level than had been predicted for the transition period. Factors that contributed to recent large requirements for petroleum include the following: (1) Military and export demands substantially above previous estimates by Government agencies; (2) the unanticipated consumption of gasoline due to the desire of returning veterans and civilians alike to take motor trips, as well as the time and income to fulfill such desires; and (3) the development of some nonrecurring demand such as the filling of consumer storage and bulk stations and terminals above the depleted levels that prevailed at the end of the war.

"The operations of the industry during the past winter were also characterized by maladjustments incident to a period of transition and to rigid price ceilings. Until January there was a relative shortage of kerosene and distillate heating oils and an abnormally rapid accumulation of gasoline stocks. The increases in ceiling prices for kerosene and distillate authorized in December and January stimulated an adjustment in refinery yields that helped to correct this condition in recent months. A tight situation also existed for residual fuel oil and was aggravated by failure to adjust prices to the extent necessary at the proper time."

Saying that developments of the next few months may cast additional light which will permit more accurate evaluation of "a rapidly changing situation," Gonzales told the compact that the committee plans to submit a more comprehensive report on the outlook for the petroleum industry at the next meeting.

In his speech on "Nonfuel Uses of Natural Gas," Vagtborg reviewed some of the possibilities that lie ahead in the chemical utilization of gas. Science, he said, has only "scratched the surface" in its employment in the manufacture of synthetics.

He visualized the growth of new industrial empires as a result of synthetics manufactured from gas. The ability to interchange forms of the nation's natural resources in the production of raw chemicals has added to the necessity of conservative uses of such resources, he continued.

Vagtborg said one company had listed 85 organic chemicals as available from natural gas, and another reported 71 products made from only isobutylene. The four chief methods of processing, he said, are decomposition, oxidation, halogenation, and nitration.

Kemler emphasized that conservation is not retarded use of a product, but instead its most efficient utilization. His subject was "The Possibilities of Research in Bringing About More Efficient Recovery and Utilization of Oil."

"Great strides have been made by the industry working on a competitive basis in the improvement of oil recovery methods and in the utilization of crude petroleum," he declared.

In the principal address at the compact's banquet, Governor Laney reviewed efforts of state officials in Arkansas to spur the industrial development of the state. Some taxes, he said, have been cut, and governmental economies effected. "We are happy to note an increase in the number of oil and gas men coming into our state," he said.

At a luncheon session, former Governor Jones called for the industrial development of the South. Measured by the accepted yardstick of economics, the South should be the richest portion of America, yet it is the poorest, he said. "The obvious conclusion is that we still live deep in a raw material economy."

Left: Two research scientists who addressed the compact were Dr. Harold Vagtborg, director of the Midwest Research Institute, and E. N. Kemler, head of the engineer research division, Southern Research Institute

Among the industry representatives and state officials at the meeting were Raymond B. Kelly, Pure Oil Co., Olney, Ill.; Milton H. Fies, consulting engineer and Alabama compact representative; and M. R. Wagner, member of the Montana oil conservation board

THIS WEEK

INTERNATIONAL— U. S. lifts ban on exports to Argentina. . . . Market for millions of dollars of American oil equipment freed. . . . Argentina has funds and badly needs material to replace equipment largely deteriorated since 1942 when imports were halted. . . . YPF alone plans purchases of $50,000,000 the next 2 years. . . . ¶Russia's exact maneuvers are again shrouded in secrecy. . . . She indicates willingness to recognize claims of American and British companies to Austrian properties. . . . Companies question whether they can operate as before the war. . . .

NATURAL GAS— FPC winds up regional hearings at Charleston, W. Va. . . . Attention in the gas investigation turns to Washington where final, over-all hearing opens June 17. . . . Charleston witnesses warn against extension of federal control. . . . ¶Observers predict favorable FPC decision on Texas-Los Angeles gas line about June 1 as agency takes further testimony in Los Angeles. . . . No opposition of consequence appears. . . . ¶Lawyers reported studying if easements on Big-Inch lines are valid in case of use for natural gas. . . . SPA's disposal recommendations bring continued dissatisfaction. . . . House expenditures committee schedules early hearings on the recommendations. . . .

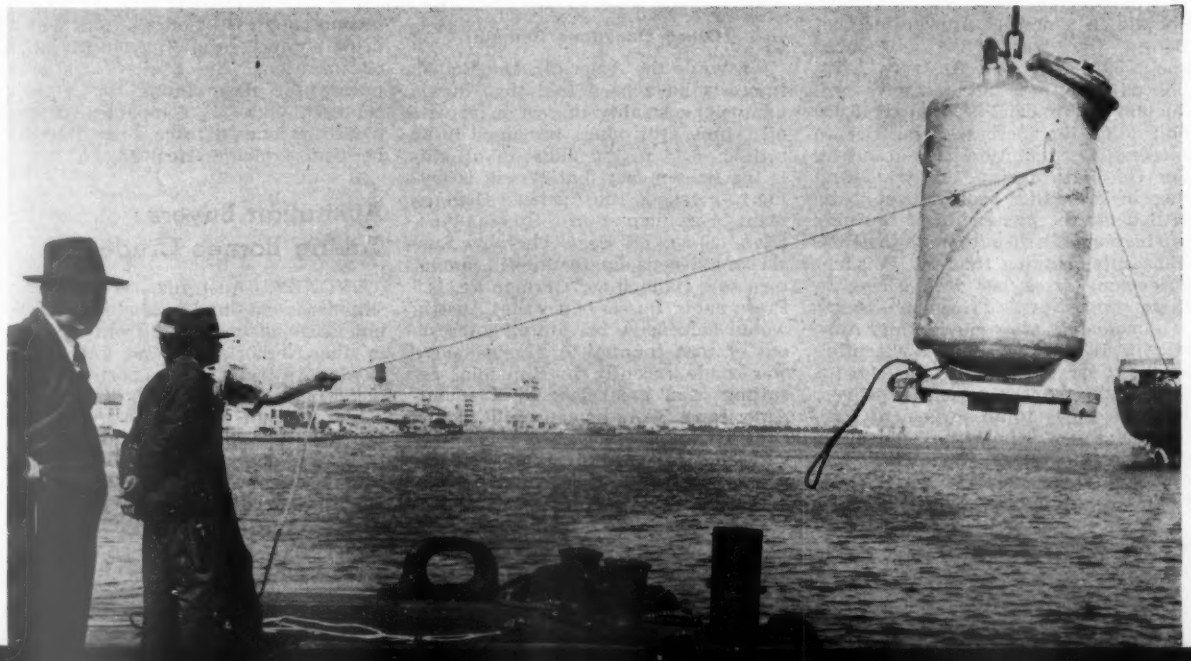
REFINING—Protests against CPA's allocation of lead for TEL increase. . . . A general degrading in octane ratings to 74 for housebrand and 79 1/2 for premium in the Mid-Continent begun. . . . Continued pressure by industry and consumers considered necessary to keep May and June lead quotas from falling below the 3,500-ton April figure. . . . ¶Need for expanded natural-gasoline market seen at N.G.A.A. meeting. . . .

REGULATION— Interstate Oil Compact in Tulsa runs head-on into question of whether it can legally discuss price. . . . Compact takes no action on Anglo-American treaty, defers decision on support stripper subsidy. . . . Its new economics advisory committee predicted continued high crude demand for the remainder of 1946. . . . ¶Texas Railroad Commission issues order allowing 24 producing days for April, adding 3 days. . . . Last ditch resistance to federal pressure for more production commended by independent producers. . . . Commission to hold important May allowable hearing this week in Austin, with stock reports due from industry. . . .

PRICES—Oil decontrol in 6 weeks, perhaps sooner, seen as a result of moves in Washington. . . . Quiet decontrol conferences reported held by Snyder with A.P.I. leaders, major company officials, and Navy. . . . ¶Refiners continue to talk higher prices for gasoline, but nothing materializes. . . . ¶Gasoline demand mounts under approaching summer weather, hits highest figure in months. . . . Crude production stocks for the week ending April 6 shows 3,780,000 drop. . . .

PRODUCTION— Shell brings in world's deepest producer near New Iberia, La. . . . The well is producing 33-gravity crude from 13,778 ft. . . . Previous record for deepest producer was held by another Shell well 400 ft. distant which produced distillate from 13,520 ft. . . .

Dr. J. J. Jakosky and Robert F. Bauer, of the research department of Union Oil Co. of California, have invented a steel diving chamber to facilitate exploration work in the Gulf Coast area and preliminary tests conducted in Los Angeles Harbor and later in the ocean off Point Firmin in California have proved successful. The diving chamber is equipped with detachable weights and in any emergency a total of 1,250 lb. of weight can be dropped and the bell will return to the surface. The chamber weighs 3,200 lb. with complete gear and including the weight of an average man. It has a skin thickness of ½ in., well above the safety factor for comparatively shallow diving, and is 7 ft. high by 4 ft. wide. It carries 1 week's supply of oxygen, is equipped with a gravity meter and chemical means for purifying the air. Readings can be taken with the gravity meter to determine the location and extent of submerged salt domes



International

NEWS FROM FOREIGN OIL COUNTRIES

Russia "Recognizes" Private Ownership of Austrian Properties, But Exact Status Remains a Puzzle

VIENNA.—While Russian policy regarding ownership of Austrian oil properties belonging to Socony-Vacuum Oil Co., Inc., Shell Oil Co., Inc., and Van Sickel Co. has apparently changed in that Russia states it will recognize certain private ownership claims, the exact status remains somewhat of a puzzle.

Specifically, Russia has indicated that she will recognize foreign titles to producing fields that were owned by Americans and the British prior to the war and which the Nazis regarded as alien property. This means that the Zistersdorf holdings of "Rag" and the oil properties of Van Sickel, the latter owned by a Canadian, presumably will be turned over to these companies and that the Russian managers will step aside. Previously, the field operations and sale of crude were directed by a Russian manager. "Rag" is an abbreviation for Rohoelgewinunngs Aktien Gesellschaft, and is owned jointly by Shell and Socony-Vacuum.

The puzzle to the Russian statements lies in the fact that while Russia "recognizes" that the above named companies own the properties, the companies concerned are not yet sure to what degree they'll be allowed to operate in a normal prewar manner. Before the war, "Rag" produced about 30 per cent of Austria's 2,400-bbl. daily output, but currently production in Austria is around 15,000 bbl. daily, the increase being due to successful exploitation carried out by the Germans during the war. And therein is another problem yet to be settled for the ownership of the new production is in dispute, with the Russians still claiming that the Potsdam agreement gives her free access to these properties as "German assets."

Immediately after moving into Austria in 1938, the Germans "legally" acquired large leases in Austria, by forcing the owners to sell. However, Russia is party to an agreement stating that she will hold the acquisition of property as illegal if the Nazis obtained it under duress—even though the procedure appears "legal."

There were no German oil interests in Austria before 1938, but today there are four other companies besides "Rag" and Van Sickel. They are: Erdoel Produktion Gesellschaft, in which Germans bought out 50 per cent of capital formerly held by Swiss interests, with Austrians holding the remainder; Nieder Donau Co., formed under German law and which operated oil fields owned by "Rag"; Deutsche Erdoel Co., which acquired certain Van Sickel oil fields; and Internationale Tiefbohr - Kommandite Aktien Gesellschaft (commonly known as "Itag), which acquired certain British oil interests through duress.

As for the disposal of the above named four companies, Russia takes the stand that they were rightfully Nazi properties and thus "German assets." If Russia succeeds in establishing this claim, the American and British oil interests would lose title to exploration properties for which they paid large sums to private Austrian interests. Later the Nazis forcibly took over these interests, paying the Americans and British only the survey costs. That these properties produced oil is indicated in the current production figures of 15,000 bbl. daily.

Other Questions Remain

So, while the American and British interests have been told that Russia admits the legality of certain private oil claims, still others remained to be settled. And in the midst of all this is the known fact that Russia is trying to persuade the Austrian Government to participate in a Russian-Austrian, 50-50, oil deal whereby Russia would consolidate the oil companies now claimed as "German assets." Presumably Russia hopes that Austria would help drive private oil interests out of that country. A similar move was made recently in Rumania, resulting in a great loss by Romano-Americana, S. A., owned by Standard Oil Co. (N. J.), which tried to compete with the Russian-Rumanian oil company. Private oil properties in Hungary may follow a similar pattern, although the U. S. State Department reportedly has told Russia that all Russian personnel must be withdrawn from Hungarian-American oil fields.

Another matter that still remains to be settled in Austria is the vast amount of British and American oil equipment which has been removed by Russia.

Socony-Vacuum entered Austria in 1924, and its production in the Zistersdorf field (located about 50 miles northwest of Vienna) is part of the company's large Austrian holdings known as Freischarf territory. As a producing unit this company operates under the name Socony-Vacuum Oil Co., and as a marketer and refiner, under Vacuum Oil Co.

Socony-Vacuum oil properties, production, refining and marketing, represent approximately 15 per cent of all Austrian oil properties and are valued at $40,000,000.

Decree Banning Strikes Repealed in Venezuela

CARACAS.—Unionized Venezuelan oil workers were given a stronger bargaining position for their contract negotiations with oil companies as a result of the Government's repeal of its decree prohibiting strikes and lockouts.

The revolutionary Government Junta revoked its own strike ban ruling a day before the opening of the second congress of oil workers which drew a representation from 37 labor organizations. The workers are preparing for negotiations for a new contract with oil companies to replace the one in force since December and expiring April 16.

Australian Buyers Taking Borneo Crude

SYDNEY, Australia.—Offshore shipments of approximately 83,000 bbl. daily of crude oil from Borneo, in the Netherlands East Indies, to Clyde, Australia, are reported to be under way. This constitutes the first offshore crude shipments from Borneo since the end of hostilities. Three British tankers are now on regular runs between Borneo and Clyde.

With the resumption of crude de-

liveries, Shell Co. of Australia, Ltd., put its 2,000-bbl. daily capacity refinery at Clyde back on stream. The refinery, which has a 1,000-bbl. daily cracking capacity, had been closed since January 1942.

Crude shipments and refinery operations will be carried on under "sterling bloc" arrangements, according to statements here, with offshore crude shipments from Borneo to be stepped up as soon as additional tankers are available.

Kuwait's Crude Expected To Be Refined in France

NEW YORK.—When Kuwait's offshore crude shipments commence about May 15, it is expected that the crude will be refined somewhere in France. Kuwait Oil Co. is jointly owned by Anglo-Iranian Oil Co., Ltd., and Gulf Oil Corp. Plenty of crude is available for Anglo-Iranian's Abadan refinery it is pointed out and there is no refinery in Kuwait. Moreover, the oil will not be marketed in the immediate area.

Initial production in Kuwait is expected to be about 30,000 bbl. daily with production coming from six dual-zone producers in the Burgan field. Offshore shipments have been held off because of lack of construction material at Fahahil (Ahmadi tank farm) directly east of the Burgan field, and pipe line loading facilities.

Kuwait's reconditioned wells, which were plugged with cement in 1942 when Nazi invasion was feared, are reported to be testing on ¾-in. chokes with no sand. Two strings of tools are engaged in the reconditioning work.

While the initial 30,000 bbl. daily is expected to come from six wells, nine have been reconditioned, and additional wells are expected to be drilled in the near future.

Anglo-Egyptian Brings in Wildcat Test Near Suez

CAIRO, Egypt. — Anglo - Egyptian Oilfields, Ltd. (Royal Dutch-Shell) has confirmed reports of a wildcat recently brought in at 2,700 ft. on the east coast of the Sinai peninsula, about 40 miles south of Suez. The well. SUDR, which is jointly owned by Anglo-Egyptian and Socony-Vacuum Oil Co., Inc., had a good show of oil and is to be tested shortly, "but it's too early to express an opinion of its possibilities," an Anglo-Egyptian official said.

The Sinai peninsula is situated at the northern end of the Red Sea. Currently all crude in Egypt is drawn from the Ras Gharib and Hurghada fields in the Gulf of Suez, with Ras Gharib accounting for about 24,000 bbl. of Egypt's current 26,000-bbl. daily output.

Argentine's 1945 Output Shows 5.6 Per Cent Drop

BUENOS AIRES. — Crude production in Argentine in 1945 amounted to 22,880,000 bbl., a decrease of 5.6 per cent from the previous year, according to figures released by the Secretary of Commerce to the Argentine press.

Of this production, the government's oil administration, Yacimientos Petroliferos Fiscales, produced 15,453,863 bbl., a decline of 4.6 per cent. Private production accounted for 7,426,143 bbl.

For December, crude production totaled 1,917,833 bbl., a drop of 148,620 bbl. Government production was 1,301,564 bbl., a drop of 6 per cent, and private production, 616,269 bbl., a drop of 9.7 per cent. Natural gas production in 1945 fell 8.1 per cent to a total of 21,495,915,000 cu. ft.

Union Oil to Start Paraguay Test Soon

LOS ANGELES.—A. C. Rubel, vice president of Union Oil Co. of California, left here recently for Paraguay where the company is scheduled to start a wildcat test within the next several weeks.

Drilling & Exploration Co. dispatched construction crews more than a month ago, and drilling crews will be on the job soon. Union Oil has until June 30 to start operations. In the meantime seismograph crews will continue operations in the area. Union's first wildcat will be in the Chaco region.

Sun to Start New Nova Scotia Test

AMHERST, N. S.—Sun Oil Co. is planning to begin drilling of a second test well in northwestern Nova Scotia as soon as the weather becomes favorable.

The new test is to be drilled close to the site of the first well near here which was abandoned at 6,001 ft. It will seek production in the Chester zone of the Mississippian. The derrick for the second test has been skidded to the new location. In the first test, part of the tools and casing was lost during a fishing job. James Mosier, Sun geologist from Tulsa, is here to direct work on the second test.

Increase in Oil Exports Reported in Venezuela

CARACAS.—A marked increase in Venezuelan oil exports, much of which goes to the United States, has been unofficially reported here for the first quarter of 1946.

January exports were 32,397,400 bbl., highest total for any month of 1945 and an increase of about 2,250,000 bbl.—more than 11 per cent—over the 1945 monthly average.

The reports here substantiated official United States import figures which showed United States imports of crude for January were 85 per cent over the corresponding month of 1945 and 2% per cent over December 1945. Most of United States' imports were from Venezuela.

International

NEWS FROM FOREIGN OIL COUNTRIES

Russia Reported Laying New Urals Pipe Line

WASHINGTON. — Development work in Soviet Russia's so-called second Baku region in the Urals is being pushed with the construction of a new 125-mile pipe line from the Tuimazy fields to the refinery at Ufa.

According to reports in the Soviet press which have been received here, 20 wells are now operating in the Tuimazy area, and a number of others are being drilled. Soviet geologists consider the Tuimazy area the most promising oil-producing territory in the region between the Volga River and the Urals.

Puerto Rico Grants Exploitation Rights

SAN JUAN, P. R.—Exclusive rights to exploit the possible oil resources of this island have been granted to the Development Co. of Puerto Rico, a government-owned company, under Act No. 243.

This act amends the old Spanish Law of Mines of July 6, 1859, repealing some of the sections, and granting the people of Puerto Rico, through the Development Co., exclusive power to exploit the island's oil resources.

Preliminary geological surveys are reported to have been made by this new company, revealing the possibility of island oil. Private owners will be given a 12½ per cent royalty. Currently the island imports fuel oil for industrial work and electric power.

Radar to Be Used in Bahama Exploration

NASSAU.—Geophysical surveys now being conducted by Standard Oil Co. (Bahamas) in the island's water concessions will soon employ radar. This will be the first time that radar has been used in the company's operations. The equipment, installed in a ship offshore, will aid in establishing fixed reference points in connection with gravity-meter surveys.

International
NEWS FROM FOREIGN OIL COUNTRIES

Restoration of Oil Properties

by Warren W. Burns

Chief unknown factor in arriving at estimates of the cost of rehabilitating NKPM's oil installations is the condition of the stills, piping, pumping apparatus, and other equipment which must be fully inspected before it can be determined whether it is usable or whether it will have to be replaced.

View of the Nederlandsche Koloniale Petroleum Mij. Palembang refinery before its military destruction

NEW YORK.—While no predictions can yet be made as to when Standard-Vacuum Oil Co.'s Netherlands East Indies subsidiary, Nederlandsche Koloniale Petroleum Maatschappij, can initiate a rehabilitation program for its wartorn properties there, it is estimated that an expenditure of from $35,000,000 to $60,000,000 will be necessary to bring these properties back to normal peacetime operations.

This statement was made to The Journal by L. W. Elliott, vice president of Standard-Vacuum, who explained that NKPM's general manager, Edward N. Leibacher, has been in Batavia, Java, with a skeleton staff of executive and skilled personnel since last October in order to aid former company employes, in any way possible, and to formulate preliminary plans for reentering the oil areas when conditions permit.

Elliott was an Army colonel during the war and spent 3 years in the Pacific area. For his work in handling oil operations there for the Army and Navy he was awarded the Distinguished Service Medal. He took part in advance operations in the Leyte and Luzon invasions, directing the laying of pipe lines and the erection of oil-storage supply depots. Prior to the war, he was general manager of NKPM in Java and Sumatra, and when the Japanese invaded these islands, in February 1942, was present to witness the destruction of the company's oil properties, including the $30,000,000 Palembang, Sumatra, refinery by the Netherlands military government. Following this destruction, Elliott escaped and joined the Army, being attached to General MacArthur's headquarters. Since being discharged, Elliott has visited the Netherland Indies and only recently returned.

L. W. Elliott, vice president and director, and H. W. McCobb, of Standard-Vacuum Oil Co. Elliott has worked recently at Batavia, Java. McCobb is now handling production problems for Standard Vacuum, and was production manager for NKPM before the war

H. W. McCobb, who is now handling production problems for Standard-Vacuum, and who was NKPM's production manager before the war, also witnessed the destruction of NKPM's oil properties and has also recently visited the Netherlands Indies. After escaping from Sumatra, McCobb joined the U. S. Army in Australia, became a colonel and served in North Africa. During the final 2 years of the war he was attached to the Army-Navy Petroleum Board, in Washington, finally as deputy executive officer.

Explaining the uncertainty as to the expenditure which will be necessary to rehabilitate NKPM's oil properties in the Netherlands Indies, Elliott said that the chief unknown factor is the condition of the stills, piping, pumping apparatus, and other equipment which must be fully inspected before it can be determined whether it is still usable or whether it will have to be replaced. Another factor is the extent to which new installations may be required for expected expansion of the Far Eastern markets. And still another is how much and from what source war-damage indemnification will be made to the company.

Standard-Vacuum's N.E.I. May Cost $60,000,000

International
NEWS FROM FOREIGN OIL COUNTRIES

Unrest among the Indonesian population, since Japan's defeat, has so far prevented industrial rehabilitation plans, according to almost daily reports from the N.E.I.

Before the war, Nederlandsche Koloniale Petroleum Maatschappij (Colonial Petroleum Co.) operated a large modern refinery at Palembang in south Sumatra and turned out a complete line of products, including aviation gasoline. NKPM produced and refined about one-third of all N.E.I. oil prior to hostilities. The wax plant at Palembang, one of the world's largest, had an annual capacity of 36,000 tons which was exported to the entire world, but principally to China and Japan.

The Palembang refinery—or rather what is left of it after the Netherlands military government destruction, of February 15, 1942, and Allied bombing in January 1945—is located at Soengei Gerong at junction of the Komering and Moesi rivers, about 5 miles downstream from the city of Palembang and 60 miles upstream on the Moesi from the Banka Straits. Palembang is approximately 300 miles from Singapore and about the same distance from Batavia, Java.

By reason of its strategic location with reference to the markets of the Far East, this refinery supplied petroleum products to a large part of that important market. The products were delivered to ocean-going tankers which were loaded to only 50 or 60 per cent of their capacity on account of the Moesi bar having an average depth of 19 ft. at the entrance of the river. The remaining percentage of cargo was completed at NKPM's Tandjong Oeban bulk terminal, located about 30 miles southeast of Singapore on the Dutch Island of Bintang in the Riouw Straits.

Refinery construction at Soengei Gerong dates back to 1923 when NKPM began preparations for the erec-

Right: Despite dock strikes in Australia and elsewhere, there is considerable activity in Batavia. Photo shows needed supplies of flour being unloaded at Batavia. (British Official Photo). Below: Partial view of NKPM's destroyed tanks at Palembang. The photograph was taken late in September 1945

tion of a small plant. The site was not only covered by dense jungle, but was literally swamp land. First, about 100 acres of this jungle area had to be cleared and millions of cubic yards of sand from the adjacent rivers were pumped in to raise the site above water level, after the completion of suitable retaining bulkheads. Most of the refinery equipment is supported on piling, and almost 1,000,000 lineal feet of piling have been driven since 1923.

At the time of the refinery's destruction (February 1942), it was capable of operating at a capacity of from 47,000 to 50,000 bbl. of crude daily, Elliott explained. The crude was received through two 8-in. and one 6-in. pipe lines from the producing fields located about 85 miles west at Talang Akar-Pendopo in the Palembang residency. The development of these fields is an outgrowth of NK PM drilling operations which commenced in the N.E.I. in 1912.

Extraordinary difficulties presented themselves in the construction of NK PM's refinery as well as the development of the producing areas and the task of transporting the crude from wells to refinery, according to both Elliott and McCobb who spent many years in the Dutch East Indies prior to the war. The high paraffin content of the crude caused it to congeal to such an extent that it made pumping difficult, especially through the jungle and swamp areas encountered from its source in the Talang Akar district to the refinery at Soengei Gerong. Some 40 miles of earthen dike, with trestles to support the line across the swamp areas, had to be built. In addition a wide path had to be made through the jungle to permit the sun's rays to reach the pipe line.

This was a difficult task, Elliott and McCobb explained, and was handled by Indonesian labor with "patjools" (Indonesian hand hoes). But in spite of the many obstacles the lines were laid and with the aid of two pumping stations, one at Talang Akar and the other at Pendopo—with a booster station located midway at Djamboe—the crude reached the refinery and was processed in a battery of eight atmospheric shell stills and two vacuum pipe stills.

Tankage Required

The tankage required for crude and refined products, at the refinery, was approximately 3,000,000 bbl. In addition 1,000,000 bbl. of tankage were required at Tandjong Oeban for receiving finished products from the refinery as well as for making deliveries to the company operated ocean-going tanker fleet.

Despite the fact that much of the equipment was destroyed by blowing up the lines and refinery and by plugging the wells with cement, prior to the Japs' arrival in 1942, Elliott reports that by early 1943 the Japanese had rebuilt much of the equipment and were refining up to 20,000 bbl. daily at Palembang, as well as running from 30,000 to 35,000 bbl. daily through repaired pipe lines from partially reconditioned wells. To do this, it was obvious that Japan's preinvasion information on NKPM's entire oil operations was excellent, this oil executive pointed out, adding, however, that no Japanese had ever been on the company's payrolls.

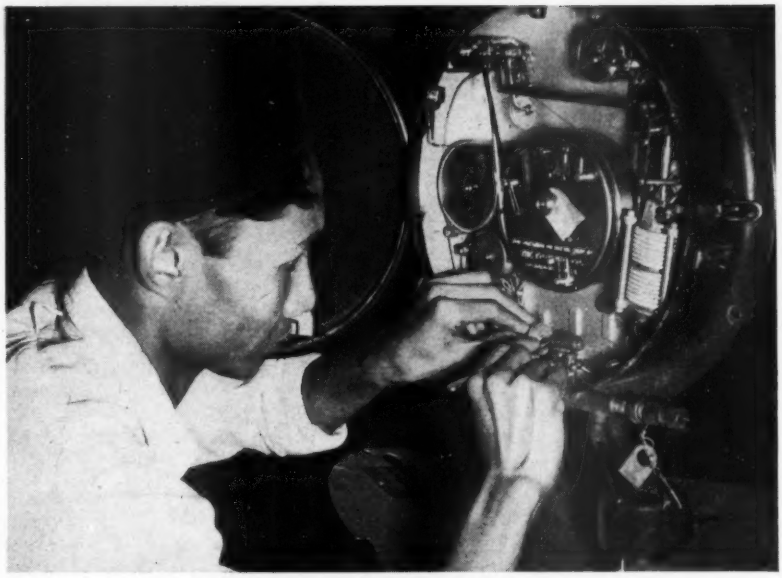
To substantiate this statement that Japan was intimately acquainted with NKPM's prewar operations, it was explained that while the company had removed all records before the "scorched earth policy" was applied, Elliott found, on his recent trip to Palembang, that during the Japanese occupation all work records had been kept on identical forms—and in English—which NKPM used in prewar years.

When the Jap invasion forces came to the N.E.I., technical "petroleum battalions" accompanied them, with the necessary scientific equipment and "know how" to rehabilitate the destroyed oil properties. This was part of Nippon's general pattern of conquest. Of course, following the Japanese rehabilitation of NKPM's properties, the Allied air forces, in January 1945, destroyed much of the Japs' rehabilitation work, causing considerable damage which has not yet been repaired.

Today the Palembang refinery is still guarded by Japanese and is in a poor physical condition, Elliott reports. However, 47 of the 55,000-bbl. storage tanks were completely rebuilt by the Japs and relatively little equipment was removed (aside from bomb damage which was considerable), although some of it has been switched about the plant. As in the operation of certain Philippine industries, this oil man said, the invaders ran them with little or no attention to maintenance, which indicates that it will be necessary to recondition the stills and renew a large portion of the equipment involved. This will be a major task, he indicated.

Summarizing his remarks on the Palembang refinery construction, Elliott said that the initial crude capacity, in 1926, was 3,500 bbl. daily. In 1929 this was hiked to 7,000 bbl. daily and 2 years later to 25,000 bbl. daily. With the erection of a new battery of crude stills and four tube and tank cracking coils, in addition to two pipe stills and a complete wax plant, the final increase in refining capacity was made in 1936 bringing it to approximately 50,000 bbl. daily. The aviation-gasoline plant was constructed in 1939 and put into operation just 11 months later—in April 1940.

Typical camp residences for employes maintained by NKPM in the Pendopo field, Sumatra



Indonesian worker adjusting a precision instrument (Official Netherlands Photo)

While NKPM's large refinery operations are at Palembang, on Sumatra, the company has a 300-bbl. daily topping plant at Kapoen, Java, which is now in the hands of the Indonesians. Just prior to the Japanese invasion the crude for this operation was obtained from settled production in NKPM's East Java fields, and was drawn principally from about 15 wells. The output from this plant was absorbed in the local market, none of it being exported.

And while NKPM did not export any crude from either its Java or Sumatra operations, refined products from Palembang were marketed along the China coast, in Japan, South Africa, Australia, New Zealand, Malay States, Siam, and some in India. At an uncertain date in the future, it is expected that these marketing operations will again be supplied with products from the N.E.I., Elliott stated, adding that the postwar demand in the Far East should expand substantially as soon as normal conditions are restored.

Prior to the Japanese invasion, NKPM's annual production was approximately 15,000,000 bbl., or 41,000 bbl. daily. Of this, 85 per cent was obtained by natural flow and 15 per cent by gas lift. Except for the small East Java production, crude was obtained from some 650 wells located in south Sumatra. In addition, the company had interests in other parts of the Netherlands Indies, carrying on extensive geological and geophysical work in various parts of Sumatra, Java, Borneo, and the smaller islands throughout the N.E.I. archipelago.

Production in south Sumatra was obtained from three main fields, Talang Akar-Pendopo, Djirak, and Benakat, at depths of approximately 2,800 ft., 1,000 ft., and 1,500 ft., respectively. The crude is of 36° (API) gravity. All fields were operated on a system of pressure maintenance. In fact, Elliott explained, NKPM was one of the pioneers in pressure-maintenance operations. In all three fields, close control was maintained on gas-oil ratios, water production and bottom-hole pressure. Of the total gas produced, approximately 55 per cent was returned to the various structures for pressure-maintenance purposes. The percentage of water produced by the fields was very small. Bottom-hole pressures were maintained at an average of 70 to 80 per cent of the original reservoir pressure.

All produced gas was processed through gasoline plants for the manufacture of casinghead gasoline while recompressing the gas for pressure-maintenance injection. Natural-gasoline production amounted to 4 per cent of crude oil produced.

The fields were connected with the Palembang refinery by a pipe-line system approximately 85 miles long, consisting of two 8-in. and one 6-in. lines. The pipe-line capacity was approximately 55,000 bbl. daily.

Operate Own Auxiliaries

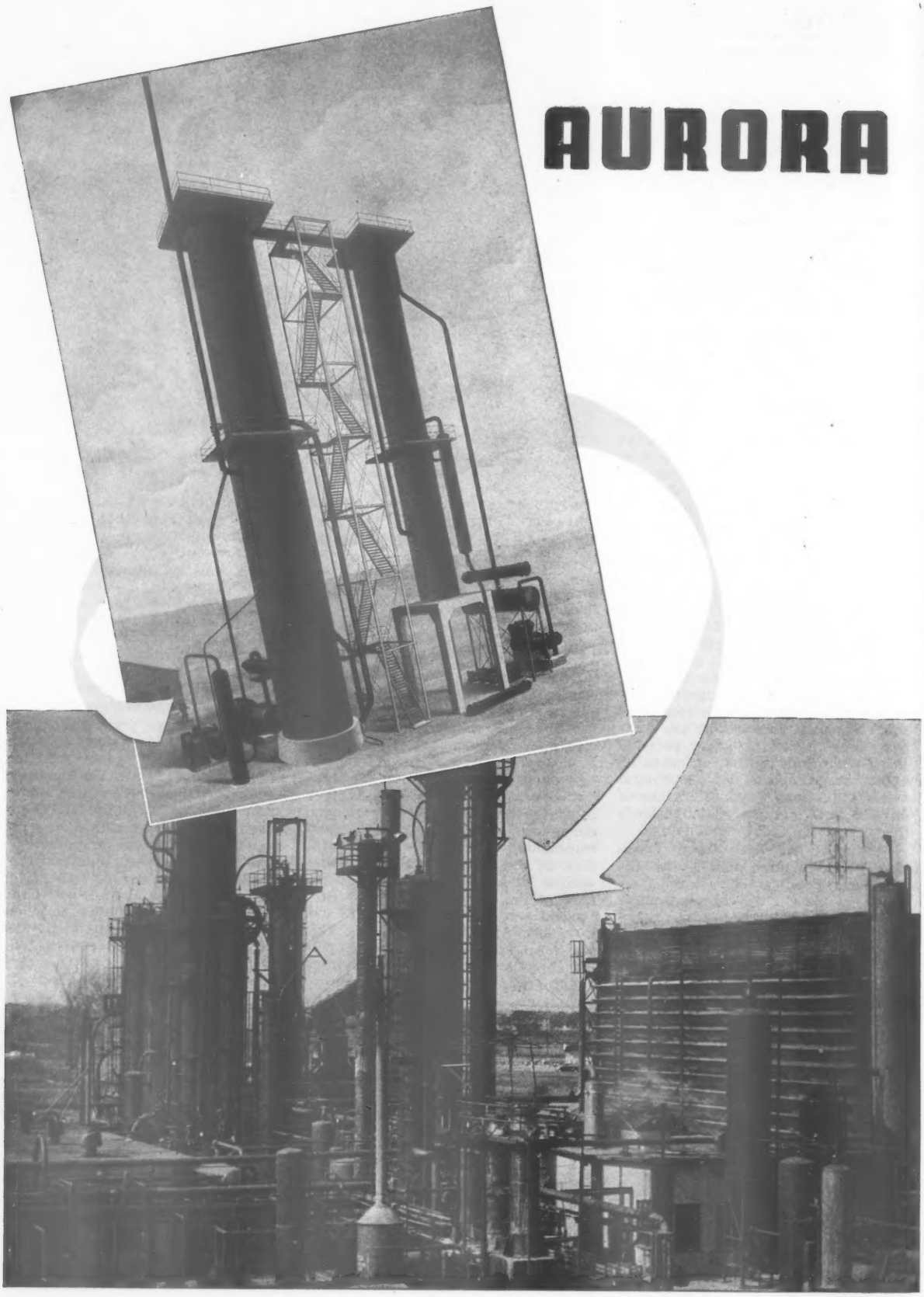
In addition to operations directly connected with drilling, production, and transportation of crude oil and gasoline, the company operated its own shops, warehouses, field transportation, water and electric supply, as well as doing all of its own construction and road building. In fact, prior to the war, NKPM employed personnel numbering about 10,000 throughout the Netherlands East Indies. Of these about 9,000 were Indonesians, including Chinese, and at the time of the invasion, some 600 Hollanders were on the staff with less than 100 American personnel. This was brought about by company policy, pursued for years, in training Hollanders and Indonesians in all departments, a practice which will be continued, Elliott explained, in postwar years. Refresher courses for key Dutch personnel are expected to get under way shortly in the United States. This oil executive was high in his praise of skilled Indonesian and Chinese labor, and said that over the last 15 years, a number of Hollanders had been trained and given experience leading to executive positions in NKPM. Training and refresher courses will have to be extensive in the years ahead, he added, as the loss of personnel, during the war, was heavy, a number of key men having met death either at hands of Japanese or had died in concentration camps.

In connection with prison camps in Java, Elliott said that he believes conditions there were worse than in the much-publicized prison camps in the Philippines. As many as 120 people are known to have been confined in a four-room house, without sanitary facilities or medical supplies, and with woefully insufficient food. On inquiry, Elliott found that any number had died from starvation, and several met death through mistreatment by Japanese captors.

The only other producer of crude oil in the N.E.I. is Bataafsche Petroleum Maatschappij (Batavia Petroleum Co.), Royal Dutch-Shell interests, whose prewar production was approximately 100,000 bbl. daily. NKPM produced about 28 per cent of the total Netherlands Indies production. In turn, N.E.I.'s total production was 2 and 3 per cent of world's total.

While NKPM and the Shell Group were the only prewar crude producers here, extensive geological exploration had been carried on in northern Sumatra by a subsidiary of Standard Oil Co. of California and The Texas Co., known as Nederlandsche Pacific Petroleum Maatschappij. Reports here indicate this company will resume its N.E.I. operations as soon as conditions permit.

During the Japanese occupation, according to an unverified report recently published in this country, drilling operations on the N.P.P.M. concession resulted in discovery of a productive area. The report, credited to military sources, classifies the Sumatra discovery one of the most important in the entire N.E.I. Previous to the war, N.P.P.M. drilled a deep exploratory test on the Sumatra concession but at that time no reports of commercial discovery were received.


AURORA

Texas Yields to Pressure and Boosts Crude Production

AUSTIN, Tex.—The Texas Railroad Commission, which finally gave in before mounting pressure and boosted the state's crude production as requested by the federal Government, early this week made preparations for what some observers considered its most important meeting in several years.

Purchasers and producers throughout Texas were assembling statistics on oil stocks which the commission requested be presented at the May allowable hearing here later in the week. The commission is seeking to determine independently the proper stock levels as an aid in fixing production. It is the first such survey conducted since 1939 when six southwestern states called a 2-week production holiday that restored cut prices.

That the commission will authorize a May output greater than the original April allowable was indicated last week when it revised its earlier order to allow some 200,000 bbl. daily more crude production. The amended order allowed 24 producing days instead of the 21 and increased permissive production to about 2,160,000 bbl. daily.

Held Out for Weeks

For weeks, the commission had held out against demands of federal officials, particularly the Navy, and of purchasers for increased production. The change in the commission's stand came after two developments: a threatened shutdown of American Liberty Oil Co.'s refinery at Texas City and other plants because of exhaustion of crude supplies; and the release by Ralph K. Davies, deputy petroleum administrator in Washington, of a telegram to the commission placing responsibility for "the threatened partial immobilization of the Navy and inability of relief ships to sail with food" on the Texas regulatory agency.

Even after the commission's revised order was issued, however, its "last ditch" stand in resisting the demands was praised by a group of independent producers. In Houston, Glenn H. McCarthy, chairman of the statewide committee of independent producers, said the group wished "to commend the railroad commission for its stand in resisting the squeeze play to meet the Navy's 'requests.'"

"Everyone wants the Navy to have the oil they need," he said. "There is no argument on that score. The independent producers in Texas say this fuel oil should be manufactured from existing stocks above the ground. Why deplete further Texas oil resources when the crude oil necessary . . . is in storage above the ground? The blame belongs in the lap of OPA. Their failure to act in this manner, which is of vital importance to every citizen of Texas, is a flagrant example of their inability to function as a ruling body over the oil industry."

Late last week, the commission received the preliminary demand forecast of the U. S. Bureau of Mines calling for Texas production in May of 2,050,000 bbl. daily. Since the figure was about 110,255 bbl. daily under the revised April allowable, Olin Culberson, commission chairman, said he could not understand the recommendation, particularly in view of the recent Navy withdrawals of fuel oil from storage which he said would indicate firm demand. Dr. R. R. Sayers, Bureau of Mines director, said the final forecast would be issued later this week but that he did not expect it to differ materially.

OPA has been invited by the commission to send a representative to the Austin hearing, but in Washington an official of the agency said only that the invitation is under consideration. OPA officials in Washington said their agency would authorize the Navy pay higher prices for fuel oil to the extent necessary to compensate refiners for any loss caused by a changed yield of products. In another statement, OPA said existing price regulations provide authority for paying higher prices to cover freight-cost differentials over pipe-line charges if the crude is to be refined for sale to government agencies such as the Navy or War Shipping Administration.

May allowable hearings were set last week by two other states. The Oklahoma Corporation Commission set April 30 as the date for its statewide hearing. In Kansas, the May market-demand hearing will be held April 26 by the corporation commission.

Davies Tells Committee PAW Job Completed

WASHINGTON. — Deputy Petroleum Administrator Ralph K. Davies told a House committee Tuesday that the job of PAW is completed and if present plans carry the agency will be liquidated at the end of this month. This is the termination date previously set by Davies but as yet it has not been formally approved by higher officials.

The occasion was a review of wartime petroleum activities and a forecast of the future being held by the Lea petroleum subcommittee of the House, and for the purpose Davies called back several of his former division directors for brief presentations.

Howard W. Page, of the program division, declared that wartime rationing curtailed civilian consumption more than was believed at the time because consumption currently is far above estimates made at the end of the war and most products are in greater demand than in any previous year. The world's crude production is within 5 per cent of the maximum efficient rate. He estimated 1946 domestic crude production at 16 per cent over 1942 and foreign crude production at nearly 100 per cent over 1942. All foreign production is at the maximum and is being fully utilized, and he declared increase in foreign consumption will keep pace with increases in production so that continued exports from the United States may be necessary. Best guesses on current foreign production include around 700,000 bbl. daily for Russia and 150,000 for former Axis regions.

Philip Bohart, discussing domestic production, said that at the ends of both world wars the United States faced a very narrow margin of productive capacity over consumption demands, but between the wars the industry was able to build up a large excess productive capacity, so it is now necessary to give every encouragement to additional exploration and drilling to reverse the downward trend of discoveries. While we entered this war with a billion barrels excess capacity we now have a deficiency in reserves of 1,800,000,000 bbl., but only about 500,000,000 bbl., or less than 3 per cent of our reserves, can be attributed to war uses and the balance is due to increased civilian consumption during the past 5 years.

Other witnesses scheduled to discuss various phases of the current oil situation were A. P. Frame, director of refining; George A. Wilson, director of supply and transportation; Walter Hochuli, director of marketing; William Heroy, director of foreign production; W. R. Boyd, Jr., chairman of the Petroleum Industry War Council, and Davies himself to summarize the testimony and point up current trends.

Katz Addresses Chemists

BARTLESVILLE.—D. L. Katz, professor of chemical engineering, University of Michigan, addressed the Bartlesville Chemical Engineering Society, April 19. He discussed heat transfer through finned tubes.

WASHINGTON WATCHING

BY HENRY D. RALPH

Oil-Price Decontrol an Early Possibility

WASHINGTON.—Oil prices may be decontrolled within 6 weeks and possibly much sooner as a result of quiet conferences that have been held recently with John W. Snyder, director of the Office of War Mobilization and Reconversion.

Conferees have included some of the top men in the American Petroleum Institute and several major oil companies, joined by high Navy Department officials.

They have earnestly requested Snyder to order the Office of Price Administration to lift, or at least suspend, all price controls over crude petroleum and petroleum products immediately, without waiting until June 30 when the new law presumably will require such action, and without the "6 months" study which Stabilization Director Chester Bowles said might be necessary.

Snyder seemed impressed with the arguments that price freedom would bring more oil to consumers, not less: would not cause inflationary price increases; would encourage production of fuel oil desperately needed by the Navy and others; and would permit the industry to adjust its production and yields to market demands.

However, Snyder promised nothing except to give the matter his serious and early consideration. He has the legal authority to overrule and give directives to both Bowles and the OPA, though there is supposed to be some sort of gentlemen's agreement that he won't publicly embarrass Bowles in the exercise of this authority. Snyder has always belonged to that school of government officials favoring dropping wartime controls rapidly even at some risk, though of late he has been swayed to some extent by the other school which insists that controls be kept until it is certain that no one will be injured.

These conferences may or may not have come to the attention of Representative Wright Patman of Texas, who is well known for his ability not to miss any political bets. At any rate, on April 12 Patman released a letter to Snyder, in the name of the House committee on small business of which he is chairman, asking Snyder to lift all oil price controls at once.

Patman hung his request on the action of the Texas Railroad Commission in lifting crude production by 200,000 bbl. per day in April and said that this action "removes the last possible argument against the immediate lifting of price controls on crude oil and refined products."

It appears certain that Congress, in continuing the life of OPA, will approve the "decontrol" amendment recommended by the House banking and currency committee. This amendment requires the President to direct the removal of price controls from any commodity or class of commodities for which the domestic demand has been satisfied. This should certainly be interpreted to include petroleum products, except possibly a few specialties such as paraffin wax.

OPA Administrator Paul Porter told Congress last week that this decontrol amendment "sets a Congressional policy with which I am in full accord," and "represents as wise a legislative approach as could be devised." This should mean that it will go through Congress without opposition and become law June 30, which, in turn, should mean that oil would be scheduled for decontrol immediately thereafter.

In view of this situation it is reasonable to expect Snyder to jump the gun by a few weeks and apply the new policy to the oil industry immediately.

Construction Slowed, Not Stopped, by CPA Order

EARLY tests of the "construction freeze" order of the Civilian Production Administration indicate that it won't prove an insuperable obstacle to necessary construction of oil refineries, terminals and bulk plants. A number of very large industrial projects for other industries have already been approved, and the 71 local committees have received instructions to use good judgment in passing on applications.

While these instructions look rather severe, the essence is that applications should be granted if the project is essential, cannot be deferred, and will not use large quantities of materials which otherwise would go into homes for veterans.

The last hurdle should be relatively easy for most oil industry projects since few of them use relatively large quantities of millwork, bathtubs, and other items going into residences. Essentiality depends somewhat on local conditions, and the regional CPA committees include representatives of the local chambers of commerce who have an eye for maintaining the employment opportunities in their communities. Whether a project can be deferred may be the biggest hurdle, since most oil companies can struggle along with their present facilities for a few more months. However, the most acute pressure on building materials is expected to ease up a bit by fall or winter, and by that time the local committees should begin to be more liberal in granting industrial construction authorizations.

The net effect of the order on the oil industry probably will be to slow down construction work for a few months, thereby making it easier to complete projects already under way and giving construction designers and equipment fabricators more time to prepare for projects which will get the green light in the fall.

FPC Sidesteps Matter Of Big-Inch Pipe Lines

THE Federal Power Commission intends to lean over backwards to avoid setting government policy on disposition of the two big-inch pipe lines. Pending before it are applications from two different corporations for certificates of public convenience and necessity to purchase and operate the lines as natural-gas carriers from Texas to New York and intermediate points.

But FPC isn't going to act on them in the near future if it can help it. The Commission takes the position that the War Assets Administration, or Congress, or somebody else, should first decide whether or not the lines should be sold for gas use. If the decision is for gas use, then it will be time enough for FPC to decide what company gets the certificate.

War Assets would like to get rid of the lines and doubtless would welcome an FPC order authorizing somebody to buy them, but as a result of this "You first" attitude by the two agencies the lines probably will remain idle for a long time.

The deadlock may be resolved by

(Continued on page 105)

(Continued from page 102)

Senator Joe O'Mahoney and his Senate petroleum committee. He plans to schedule a hearing jointly with the surplus property subcommittee of the military affairs committee to discuss the recommendations of the now defunct Surplus Property Administration regarding government-owned petroleum facilities. Last fall the oil industry expressed its views on disposal of both pipe lines and refineries at lengthy hearings by the two committees, but that was before any of the properties had been put up for sale.

Various groups in the industry have since made known their criticisms of certain phases of the SPA reports on pipe lines and refineries, but O'Mahoney wants them to go into the official record and also wants to give all interested parties another chance to be heard.

However, Senate committees are notoriously slow in acting, and with Congress already talking about a long summer recess it appears that the big-inch disposal policy may remain hanging in the air for a long time.

Coops Not a Menace, House Committee Reports

FARMER cooperative associations got a pretty clean bill of health from the small business committee of the House which brought in a report last week after a year of studying charges that coops threaten the existence of independent businesses because of their preferential tax treatment.

The committee concluded that coops do a very small fraction of the nation's business and are not expanding any faster than other types of business activity. The alleged tax advantage, says the committee, is largely a misconception and is grossly exaggerated, since some types of coops have no advantage at all and the preferential treatment given others is not sufficiently large to give coops a real competitive edge over partnerships and corporations.

The committee did find that some of the coops have abused their tax-exempt privileges, and it recommended a number of changes in Internal Revenue regulations and procedure to close the loopholes. No new tax legislation is needed to deal with the problem of coops, the committee declared, since the present laws, if rigidly enforced, will prevent coops from having any competitive advantage over other types of business.

This report won't settle the argument, but the 43-page document will help a lot in clearing the air and narrowing discussion down to the real issues, because it contains a careful discussion of the various types of cooperative organization and the actual tax treatment afforded each.

TEL Shortage Becoming A Political Problem

THE shortage of tetraethyl lead is becoming a political problem. The American Petroleum Institute has sent a letter to all congressmen warning them that their constituents are going to complain unless something is done, while the National Petroleum Association has written many government officials demanding better coordination of all departments concerned with lead production, imports and use.

The Civilian Production Administration, which issued the drastic order curtailing TEL use in gasoline, feels helpless to do anything except divide the scarcity. It has asked producers to spread their output fairly among customers and is trying to locate secondhand lead in government surplus goods, but it says that strikes in mines and smelters have cut production to half of the normal output of 500,000 tons of pig lead annually.

With the possible exception of nylon stockings, lead is about the scarcest commodity in the country, and no one seems to know what to do about it. Independent refiners and marketers are hard hit, and the entire oil industry and the motoring public can make out a good case for having the TEL quota increased. But all other lead users also feel they have been shortchanged by the CPA lead restrictions, and if the solution depends on a political pressure content the oil industry will have to buck pleas for lead to paint veterans' houses and lead to make batteries for veterans' cars.

FPC Concludes Regional Gas Hearings; Final Testimony Slated for June 17

CHARLESTON, W. Va.—The Federal Power Commission's seventh and last regional hearing in its investigation of the natural-gas industry came to an end here last week on a continuing note of strongly expressed opposition to any further extension of federal control.

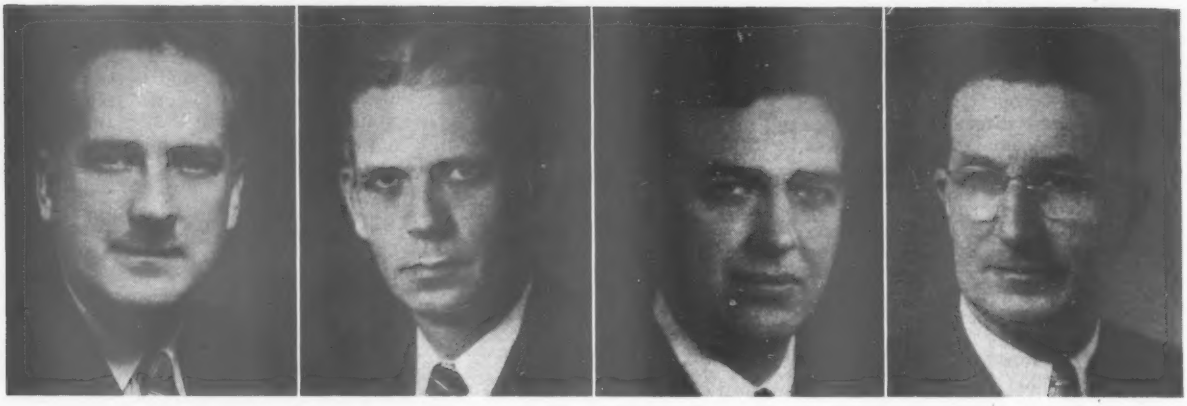
Testimony came from representatives of a region which is considered likely to lose most heavily should the Government undertake to restrict gas use where a competing fuel, namely coal, is available. Witnesses told the commission substantially what it heard from consumers the previous week here in Charleston and several weeks ago in Chicago—gas is a generally preferred fuel and its unrestricted use on a freely competitive basis is desirable.

Picturing possible results of federal control of end use of gas, William B. Harrison, president of the Louisville Industrial Foundation, said it is "not fantastic" to predict the industries using gas will find their operations curtailed and payrolls reduced, and employes will find themselves either without jobs or unable to pay for gas or the price of domestic gas so stepped up as to make it too expensive. "Obviously, it serves no good end to place gas, or any other fuel, at the disposal of domestic consumers, only to burden all of them with an excessive cost and deprive some of them of the very means with which to purchase their fuel," he declared.

Another Kentucky witness, Charles E. Whittle, chairman of the Kentucky Public Service Commission, described what he said was the "adequate and satisfactory" job being done by the state commission in regulating gas. During crossexamination by Leland Richardson, special gas counsel for the State of Louisiana which generally opposes export of gas from the state, Whittle said he believed that the granting of certificates by the federal agency for interstate pipe lines should not be used as a pretext to do indirectly what cannot be done under the law directly. He added he does not believe conservation of reserves should be given consideration as a factor in limiting industrial consumption of gas since at some future time the country will exhaust both coal and gas reserves.

One of several witnesses from New York state was Howard Pierce, Niagara Frontier Builders Association, Buffalo. He testified that during the past 10 years demand for gas heating equipment in new homes in Buffalo has been "almost 100 per cent," although the mixed gas served in the area is higher in price than other heating fuels. In crossexamination, Amos Matthews, counsel for railroad interests intervening in the investigation, attempted to show there is an almost universal demand for gas for domestic purposes, apparently with a view of reaching the conclusion the gas supply is insufficient to supply all those who want gas service.

The Charleston hearing was the last of the regional inquiries begun last September. Final testimony will come June 17 in Washington.



M. W. MORRIS LOT BOWEN E. V. WATTS EDWARD WEBB

M. W. Morris, Standard Oil Co. of California, newly elected chairman of the Pacific Coast district, A.P.I. division of production, was program chairman of last week's meeting. Lot Bowen, Western Gulf Oil Co., was chairman of the drilling session; E. V. Watts, General Petroleum Corp., was chairman of the production practices session, and Edward Webb was a member of the drilling session committee

Morris Heads Pacific Coast A.P.I.; Two-Day Meet Well Attended

by L. P. Stockman

LOS ANGELES.—For the first time since its inception, the Pacific Coast District Production Division of the A.P.I. held a 2-day session in Los Angeles April 11-12 and if the large attendance is any criterion it may become an annual custom. Inauguration of the policy of devoting 1 day to drilling problems and another to production practice made it possible for members to attend the sessions in which they were most interested.

Malcolm Morris was elected chairman of the Pacific Coast division for the ensuing year. He is petroleum engineer of the southern district, supervising drilling and production engineering for Standard Oil Co. of California in Los Angeles Basin and the Coastal area. A. M. Johnson, Shell Oil Co., Long Beach, was elected chairman of Los Angeles Basin district and A. B. Newby of Southern California Gas Co., Taft, was elected chairman of the San Joaquin Valley district. R. J. Kettenburg, Shell Oil Co., Ventura, was elected chairman of the Coastal district, and W. G. Gorey, Lacy Oil Tool Co., Los Angeles, was reelected treasurer. Chairmen of the three districts are also vice chairmen of the Pacific Coast division which embraces all areas in California. Basil Kantzer, the outgoing chairman, becomes ex officio chairman of the advisory committee.

Sen. E. H. Moore of Oklahoma sounded the keynote of the meeting when he told members that it is of first importance to keep alive the opportunities for individual initiative and to maintain assurances that the reward for success in the search for oil is commensurate with the risk involved. Of more than passing interest to the California oil industry was the Senator's statement that there has never been a more spurious or illegal attack upon the rights of sovereign states than the attempt of the federal Government to extend its power to include tidelands.

Abstracts of technical papers presented at the meeting here reported appear in the Engineering and Operation section of this issue, starting on page 158. In subsequent issues of the Journal will be published two papers, "Results and Use of Oil-Base Fluids in Drilling and Completing Wells," and "Review of Special Water-Base-Mud Developments," which were presented at the Los Angeles meeting.

Moore Deplores Socialism

The speaker deplored socialism and leftist thinking in government regimentation of industry and told members of the A.P.I. and guests that: "The war is behind us, and the industrial enterprise of this country is entitled to be free of the restrictions born of war. A free economy cannot exist without free prices. The petroleum industry occupies the unique position of being able to supply every peacetime demand upon it and yet it is still subjected to rigid price controls. Have we actually fallen a victim to the philosophy of a planned economy? Can you gentlemen of the oil industry doubt for a single moment that your industry can long remain safe from nationalism in such an atmosphere of government activity?"

Ralph Marshall, Drilling & Exploration Co., Los Angeles, presented some interesting data on drilling costs. Subsequent discussion centered around how to reduce completion time and costs. Completion time, which includes the landing of casing, liner and tubing and production equipment varied from from 10 to 20 days in 1945 and in some cases represented 20 per cent to 50 per cent of the total cost. The total cost of derrick, casing and production equipment, in contrast with other drilling costs which have practically doubled in the past decade, are substantially lower due primarily to simplification of casing programs. Marshall complimented oil tool and machinery manufacturers for making available efficient drilling equipment. In the drilling of a 10,000-12,000-ft. well, the number of drilling days decreased about 50 per cent between 1939 and 1946 and although daily operating costs rose from $725 in 1939 to $1,125 in 1945-46, the total average cost declined from $87,000 to $71,000 due to the reduction in drilling days.

W. S. Eggleston, chief petroleum engineer, Union Oil Co., differed somewhat from Marshall's data. Referring to a chart of Marshall, Eggleston was of the opinion that the chart would be more illustrative if correlated with the average depth of the wells drilled during various years. Eggleston stated that when large wells were completed, drilling costs

were relatively unimportant when payouts were relatively short. Eggleston said that, "based upon dollar oil, and average cost figures, including royalty, taxes, etc., it now requires 140,000 bbl. of oil to pay back the cost of drilling as against 89,000 bbl. in 1941. Expressed another way, for an ultimate production of 250,000 bbl. of oil, the depreciation rate has increased from 20 cents to 31 cents per barrel. This is not the whole story since we are getting fewer of these 250,000 bbl. ultimate wells, and based upon recent discoveries and completions throughout the state, ultimate expectation would indicate a depreciation figure of closer to 40 cents per barrel as against 20 cents or 25 cents per barrel prior to 1941. Few producing properties can withstand this sort of economic squeeze, higher drilling costs and lesser ultimate expectation in terms of oil to be recovered."

Gas Injection in Canal Field

Consulting engineer, Ernest Parks, challenged opinions of R. P. Mangold, Shell Oil Co., with regard to the importance of the gas injection project in the Canal field of Kern County. Parks expressed the opinion that the effect of gas injection in the Canal field was of greater importance than was indicated but Mangold was of the opinion that it is still too early to definitely determine what has been accomplished. Asked about what has been done and what would be done with respect to the gas cap, Mangold stated the present cost appeared out of proportion to what could be expected. To remedy wells would represent a cost of about $250,000 and to recover this sum above expected ultimate would mean the production of approximately 1,250,000 bbl. of additional oil. Because of the limited size of Canal, as compared with Ten Section, Mangold felt Shell had a better opportunity of maintaining reservoir pressure at Ten Section because of its larger areal extent.

Some difference of opinion also existed about the effectiveness of the gas storage program at Playa Del Rey as presented in a paper by L. S. Kelsey and E. C. Babson of Union Oil Co., Dominguez. The authors concluded that this gas storage project was entirely justified and that it is serving its primary purpose which was injection of gas during periods of low demand and taking it out in periods of peak consumption.

R. L. Minchler, vice president of General Petroleum Corp., presented a paper on the outlook for California oil in which he pointed out normal expectations and what must be done to meet this future demand which he expects will be far in excess of what was formerly considered normal peacetime requirements. The principal reason for this anticipated increase in demand is industrial activity in Pacific Coast territory in 1946-47 and an increase in population of the five western states along with a large industrial growth and a military demand above the prewar average.

Minckler was concerned because California is entering the forthcoming major market with low inventories. To correct this condition approximately 30,000,000 bbl. should be added to stocks in order to bring the total to around 100,000,000 bbl. to permit efficient operation. He estimated it would require 818,000 bbl. per day to permit the necessary increase in stocks during 1946 and while military demand will slack off later this year it is felt the estimate is too low to permit any such addition to inventories. In order to meet demand from 1947 through 1950, Minckler estimated production should average between 725,000 and 744,000 bbl. daily.

Domestic demand for gasoline in Pacific Coast states is expected to reach 274,000 bbl. daily by 1950 or 28 per cent above prewar requirements. The demand for diesel and other distillate fuels in the five western states by 1950 is expected to reach 72,800 bbl. per day as compared with 49,129 bbl. per day in 1941. Space heating and railroad requirements show the largest gain, with bunker fuel less than 50 per cent of the 1941 total. Fuel oil demand in 1950 will be on about a par with 1941 although the conversion of railroads from steam to diesel will result in decreased use of fuel oil and a larger demand for diesel. Minckler expects California will be able to supply crude oil needs but believes that at the end of the period, in 1950, the margin of surplus will shrink to practically nothing.

New Firm Will Operate Black, Sivalls & Bryson

Fifty-three years ago, in 1893, A. H. Black, son of a cooper and oil-field tank builder, established himself in business to erect wooden tanks for a "young" oil industry. This week, Black and his associates and stockholders sold Black, Sivalls & Bryson, Inc., to A. J. Smith and associates for a consideration reported to be $7,000,000.

Smith, the new president of B. S. & B., announced that A. H. Black, founder and retiring president, will become chairman of the board and personal adviser to Smith. Glen Skinner will continue as vice president of the new firm. Gwynne Raymond, widely known engineer and production expert, will continue as chief engineer.

"There will be no other changes in management, personnel, or policies," said Smith, "except that we plan to expand the business to give more and better service to a growing oil industry through the manufacture of a wider line of products especially designed and proven for oil industry use."

Administrative headquarters of B. S. & B. will be moved from Oklahoma City to Kansas City from where Smith will direct the company's affairs. However, offices in both cities will be greatly expanded as will the sales force. The company's research laboratory will be maintained and expanded for the creation and designing of new products.

A. J. SMITH

Black, Sivalls & Bryson, Inc., is one of the largest and oldest concerns specializing in the manufacture of equipment for the production, pipeline and refining branches of the oil industry. It produces machinery for the fabricaton and welding of steel sheets and plates, and in its plants, offices, and sales force, employs 2,000 persons.

The principal plants are located in Kansas City and Oklahoma City. The company's products include welded and bolted steel tanks, wood tanks, oil and gas separators, pressure vessels, heaters, treaters, chemical feeders, valves, safety heads, and a wide list of special devices and mechanical equipment designed for the handling, storage, separation and treatment of crude oil and natural gas.

A. J. Smith, new president and general manager of B. S. & B., is president of Smith Engineering Co. He is widely known to the petroleum industry, especially to the refining division. A graduate of University of Kansas, Smith is credited with the development of many present-day methods of petroleum refining. He is a pioneer in refractionation and has patented inventions in the petroleum and metallurgy fields.

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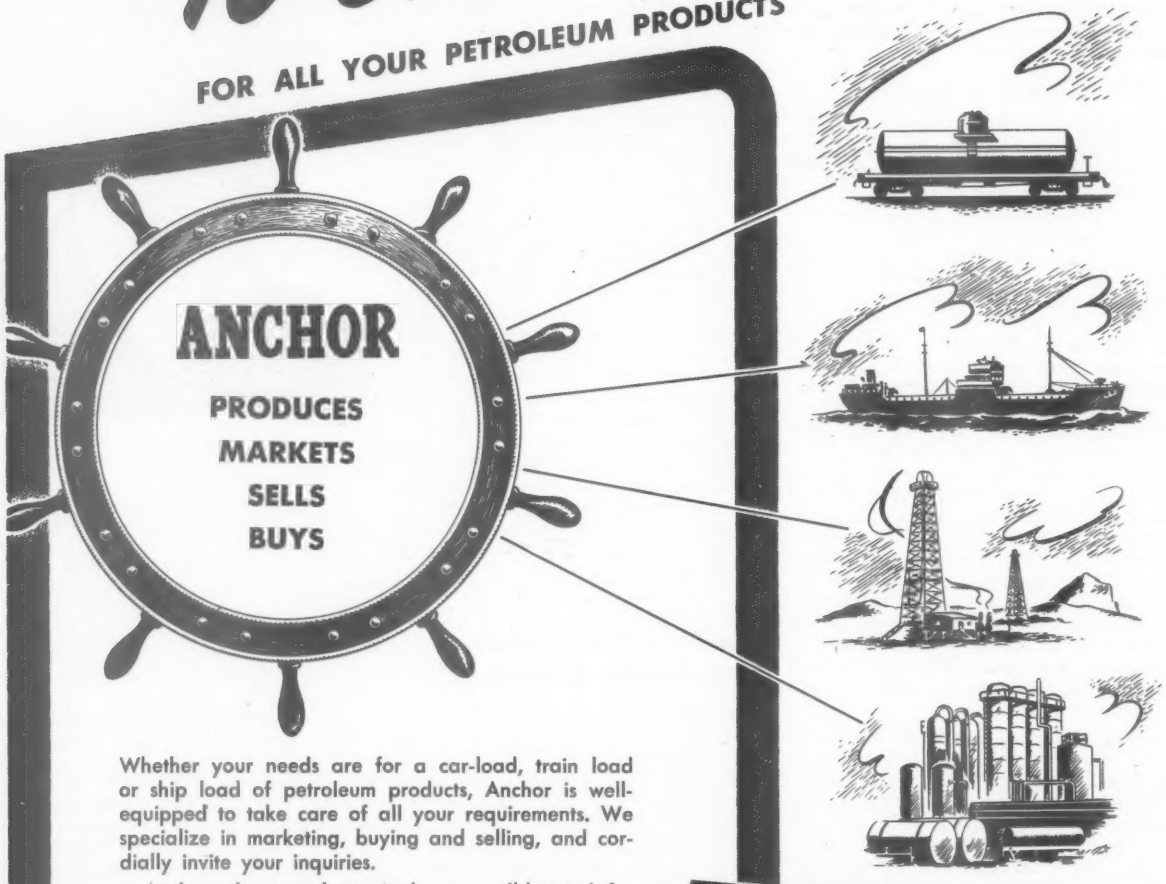

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NATURAL GASOLINE SECTION STARTS NEXT PAGE

Navy Now Operating Only One Oil Property

The Navy this week was operating only one of the 53 oil properties seized by the Government last October after a labor - management agreement was reached at American Liberty Oil Co.'s refinery at Texas City, Tex.

Return of the American Liberty plant left the Navy in charge only of Gulf Refining Co.'s Toledo refinery. An early settlement at Gulf's plant was predicted by Vice Adm. Ben Moreell, who said negotiations are being currently sponsored by the Navy.

In a different kind of repercussion of last autumn's nationwide strike, the C. I. O. oil workers union last week in San Francisco was sued in federal court in San Francisco for $100,000 by General Chemical Co. of Richmond, Calif. The company alleged the union struck illegally at the plant last November and since has maintained an illegal picket line.

An organization campaign which will extend to employes of natural gas utility companies was outlined last week at the first constitutional convention of the new C. I. O. Utility Workers Union of America. Allan S. Haywood, C. I. O. vice president, told the delegates that "today sounds the death knell for the second-class A. F. of L. membership in the utility field of America."

The labor scene in Houston was marked by comparative peace for the first time in several months. Hughes Tool Co., a major producer of rock bits and other equipment, earlier settled with the C. I. O. steelworkers union following a prolonged walkout.

Frank Leovy to Retire From Gulf Oil May 1

Frank A. Leovy, known as the dean of American oil men, is retiring May 1 from Gulf Oil Corp. with which he has been associated the last 42 years, according to an announcement made in Pittsburgh. He has submitted his resignation to the Gulf board of directors.

Leovy, 76 years old, has been an outstanding figure in the industry for nearly a half century. He joined Gulf at Beaumont, Tex., in 1904, and after holding various responsible positions in the production and pipeline department of Gulf companies in Texas and Oklahoma, he was transferred in 1914 to the executive offices at Pittsburgh where he has actively directed production and pipeline activities of the companies in the United States and abroad.

Leovy is vice chairman of the board of Gulf Oil Corp., chairman of the board of Gulf Refining Co., and a director of 10 other Gulf companies.

Curran Named Director Of Carter Oil Co.

Robert B. Curran, manager of Carter's Northwest division, was named a director of the company on April 12. One of the youngest employes in a major executive post, Curran, 37, has made a rapid rise in the oil industry, and his election to the board of directors is a tribute to his ability and past achievements.

He joined Carter's geological department in 1933 following graduation from the University of Oklahoma with a B.S. degree in geology. Later he became production geologist at Seminole, Okla.

In 1935 he was transferred to the scouting division and in 1938 was made chief scout. He became head of the scouting and statistical division 3 years later. In 1943, he was appointed assistant to the president, a position which he held for a year and a half.

Curran was transferred to Billings, Mont., in September 1944 as assistant division manager. He was named division manager in February 1945 and has served in that capacity ever since.

Program Announced for Equipment Supply Group

A full 2 days of discussions and business sessions are scheduled for the membership meeting of the Petroleum Equipment Suppliers Association opening April 23 at the Mayo Hotel in Tulsa.

Four committee meetings will be held throughout the first day of the meeting. The general membership session will be held from 9:30 a. m. to noon April 24, followed by a meeting of the board of directors of the association at 2 p. m. The group will be entertained the evening of April 24 at Southern Hills Country Club as guests of the Tulsa members.

Committee meetings on the program April 23 are: 9 a. m., sales accounting, John H. Lollar, Jr., Republic Supply Co., chairman; 10:30 a. m., transportation or traffic committee, H. C. Witt, Jones & Laughlin Supply Co., chairman; 2 p. m., sales-tax committee, Donald Brown, Bethlehem Supply Co., chairman; and 3:30 p. m., personnel and labor relations, Thomas M. Mobley, Hughes Tool Co., chairman. Hugh H. Glen, association president, said members are urged to submit in advance any questions they would like to have discussed at the committee sessions.

DEATHS

C. C. Lanier, Texas oil operator, died April 6 in Teague, Tex., shortly after he was struck by an automobile.

John Hollihan, 63, former secretary of Sinclair Prairie Oil & Gas Co. who had been associated with the company 34 years before his retirement in 1937, died April 8 in Independence, Kans.

Paul C. White, New York City, former vice president and chief engineer of Commonwealth Gas Corp., died recently. White served for several years as senior engineer for the Federal Power Commission and previously was associated with Root Petroleum Co. in El Dorado, Ark.

A. J. Pfister, Sr., 60, sales manager of Atlas Gasoline Corp., died April 9 at his home in Tulsa. Pfister was associated with Midco Oil Corp., Bell Oil & Gas Co., and Aiken Gasoline Co. before he retired in 1938. He returned to active business life with Atlas in 1941.

Paul C. White, 38, New York City, vice president and chief engineer of Commonwealth Gas Corp., died April 8 in Arlington, Va. White served for several years as senior engineer for the Federal Power Commission and previously was associated with Root Petroleum Co. in El Dorado, Ark.

Harold J. Brady, associated with Standard Oil Co. of New Jersey 37 years and a member of the managing office staff at its Bayway, N. J., refinery, died April 8 in Bayonne, N. J.

Mose L. Carr, 69, Okmulgee, Okla., pioneer oil producer, died April 12 in Tulsa. A native of Wood County, Ohio, Carr entered the oil business in 1903 in Kansas and later came to Oklahoma. He drilled one of the first major producers in the Bald Hill field and was prominent in the organization and expansion of Oklahoma Natural Gas Co.

MORE MARKET OUTLETS —Need of— Natural-Gasoline Industry

by Arch L. Foster

DALLAS.—The natural-gasoline industry must expand greatly its outlets for products if it is to remain in a healthy condition, J. H. Dunn, president of the Natural Gasoline Association of America, told the assembled delegates to the convention here this week. Something more than mere volatility must be sold to the refiner if the present output capacity of the industry is to be satisfied. The natural-gasoline industry increased its output largely because of the wartime demand for special products and fractions for the making of war fuels, and thus finds itself overflowing with materials for which the demand has been reduced seriously, Dunn said.

Outstanding progress has been made in study and solution of the problem of corrosion in high-pressure gas-condensate wells, T. S. Bacon of the N.G.A.A. Corrosion Research Project Committee reported, but much remains to be done before the problem is solved. The project is being carried on and financed by 26 companies and to date a total of $41,500 has been contributed for the work, about $30,000 of which has been spent. Cooperating in the program also are American Petroleum Institute, and National Association of Corrosion Engineers, while individual projects have been maintained at University of Texas, U. S. Bureau of Mines, and Battelle Memorial Institute.

THIS N.G.A.A. Section features a report on this week's annual meeting in Dallas and the Journal's annual survey of natural-gasoline and cycling plants, showing operators, plant locations, and capacities. Supplementing this summary of the meeting highlights are substantially complete versions of papers by J. H. Dunn, president; Henry N. Wade on high-pressure absorption, and P. E. Chaney on operation and results of detecting corrosion through use of the tubing caliper.

Reporting on one of these sponsored projects, solid sticks of sodium chromate can be introduced into wells delivering considerable quantities of fluids and serve to inhibit corrosion thereby, C. K. Eilerts of the U. S. Bureau of Mines reported. Sticks weighing 0.6 lb. were introduced into flowing wells in gas fields, after the beginning of gas flow, and exercised an inhibitory effect for 2 to 3 hours, he stated. Dissolved in the water in the well tubing the chromate tends to protect against corrosion until its concentration becomes too low, which is within 2-3 hours. Tests at Cotton Valley, La., show that such sticks can be introduced successfully at the well head into the tubing when the gas velocity is up to 11 ft. per second.

Dr. D. L. Katz stated that suitable sampling conditions have been determined for straight-pipe sections either vertical or horizontal. All available data indicate that these conditions determined upon are adequate for reliable results for liquid contents up to 12 g.p.m. Only a few tests have been made for streams having more than 1.1 gal. per M cu. ft.

Important extensions of fractionation as applied to the manufacture of wartime products from natural gasoline was discussed at length by T. W. and H. R. Legatski, technologists with Phillips Petroleum Co. They showed how natural gasoline has been broken up to produce isopentane and aviation-fuel base stocks, the operations required for this purpose, the octane ratings of the several components and the individual hydrocarbons included. The position of the refiner with regard to natural gasoline and its place in the preparation of motor fuels was presented by J. W. Vaiden, vice president, and F. E. Fisher, research director, of Skelly Oil Co. The program was completed by papers of J. E. Bludworth, Celanese Corp., on hydrocarbons as chemical raw materials; the behavior of hydrocarbons in condensate reservoirs by F. H. Dotterweich of Texas College of Arts and Industries, and E. O. Bennett, consulting engineer, which were followed by the "Information Please" session described on the facing page.

W. N. Lacey Receives Hanlon Award

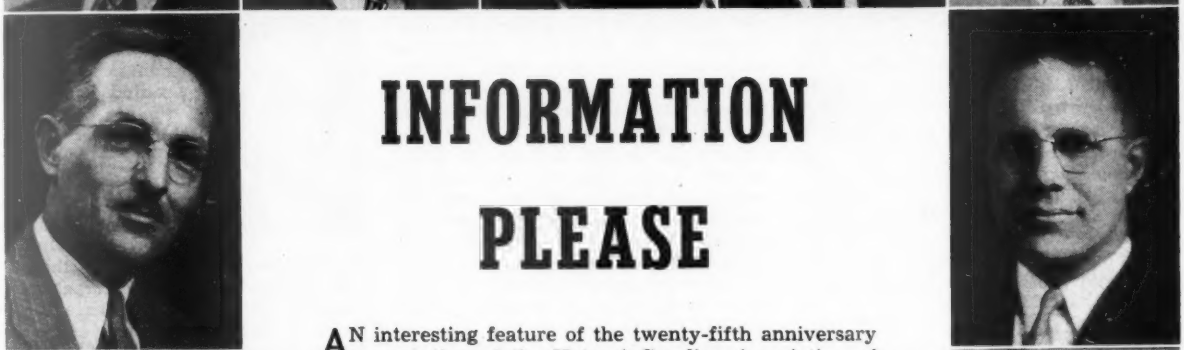
AUTHOR of nearly 80 scientific articles on physical and chemical properties of hydrocarbons and a recognized international authority in that field, Dr. W. N. Lacey, professor at California Institute of Technology at Pasadena, has been awarded the Hanlon Award for meritorious service to the natural gasoline industry for 1946. This annual award by the Natural Gasoline Association of America was made this week at its Silver Anniversary meeting.

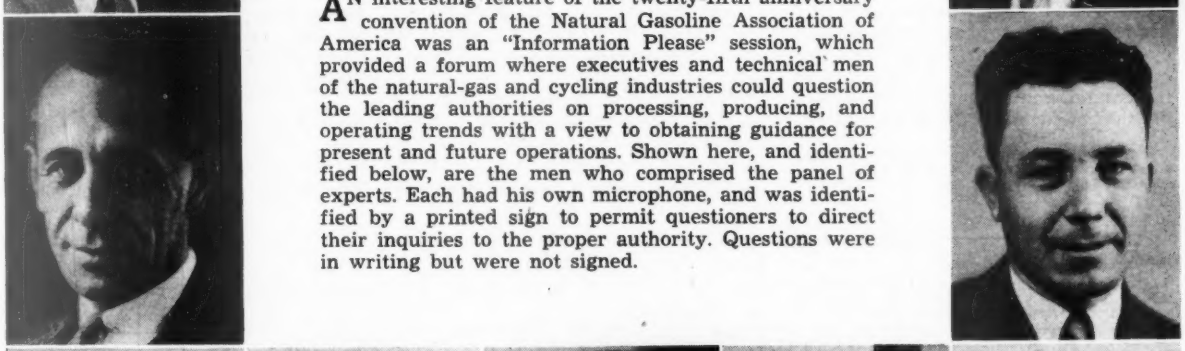
A large part of Dr. Lacey's work has dealt with original researches into phase equilibria of hydrocarbons and its application to reservoir mechanics. He has supplied the petroleum and natural-gasoline industries with precisely measured and computed values of the thermodynamic properties of pure hydrocarbons and hydrocarbon systems. His work has convinced executives and engineers of the necessity for operating petroleum reservoirs under primary pressure control, resulting in the orderly production of petroleum and natural gas.

Dr. Lacey was born in San Diego, graduated with an A.B. degree at Stanford in 1911, received the Ch.E. degree in 1912, M.S. in 1913, and the Ph.D. at the University of California at Berkeley in 1915. He entered the Institute as an instructor in 1916, and has been full professor since 1931. He served as lieutenant in the Ordnance Department in World War 1, and with Office of Scientific Research and Development in World War 2.

INFORMATION PLEASE

AN interesting feature of the twenty-fifth anniversary convention of the Natural Gasoline Association of America was an "Information Please" session, which provided a forum where executives and technical men of the natural-gas and cycling industries could question the leading authorities on processing, producing, and operating trends with a view to obtaining guidance for present and future operations. Shown here, and identified below, are the men who comprised the panel of experts. Each had his own microphone, and was identified by a printed sign to permit questioners to direct their inquiries to the proper authority. Questions were in writing but were not signed.





THE PANEL

Interlocutor was D. E. Buchanan, Hanlon-Buchanan, Inc., pictured at the extreme left of the top row. Questions were screened by a committee consisting of Henry M. Brown, Midland Gasoline Co.; W. L. Bowser, Atlantic Refining Co.; Phil D. Baker, The Carter Oil Co.; F. M. Perry, Cities Service Oil Co., and Max L. Riley, Anco Gas Co.

General and plant operation: Experts were E. O. Bennett, consultant; F. W. Laverty, Clark Brothers Co., and J. B. Taylor, Signal Oil & Gas Co., in center of top row. Also a member, but not pictured, was Dr. R. M. Reed, Girdler Corp.

Marketing and economics: Expert was J. A. LaFortune, top row, right.

Research: Experts were R. C. Alden, Phillips Petroleum Co., and Dr. G. G. Brown, University of Michigan, who comprise the second row.

Pipe-line transportation: Expert was S. S. Smith, Shell Pipe Line Co., at left of third row.

Cycling Operations: Expert was C. R. Williams, The Chicago Corp., at right of third row.

Process and design: Experts were M. H. Kotzebue, Gasoline Plant Construction Co.; R. P. Mase, Jones & Laughlin Supply Co.; P. M. Raigorodsky, Glen Rose Gasoline Co., and A. J. L. Hutchinson, Fish Engineering Corp., and Henry Noll, Houdry Corp., bottom row.

Natural-Gasoline Industry Looks Two Ways In Seeking Outlets for Products

by J. H. Dunn*

This slightly abridged version of the presidential address was presented before the twenty-fifth anniversary convention of the Natural Gasoline Association of America in Dallas, April 18. One of the foremost problems facing the natural-gasoline industry is creation of markets for butane. Reference is also made to expansion of less expensive transportation facilities and to the possibility that natural-gasoline manufacturers will be forced to compete directly in the motor-fuel market.

IN this industry, as all others, new problems take the place of old problems and it always seems that the new problems are more complex and difficult of solution than the old problems in retrospect. The industry continues to render an invaluable service in the elimination of waste and the conservation of petroleum products. In its program the industry has expanded its operations to include greater conservation activities by its participation on a broad scale in cycling and pressure-maintenance projects.

As natural gasoline went to war there were material increases in the production of propane, butanes, and cycle stocks (Fig. 1). This situation resulted from greater diversification in demand, and brought about the expansion of facilities for the manufacture of special products for special uses through the more extensive separation of the light ends. These raw materials became important for the manufacture of such products as butadiene, alkylate, cumene, toluene, and 100-octane gasoline. It is of great significance to the industry to learn by this experience and through an expanding market for liquefied petroleum gas that it has something more to sell than plain volatility to the refiner. This seems to be particularly important at this time as refinery-process engineers continue to design facilities to increase the cracking of heavy products into light ends with the tendency to disregard the desirability of balancing the total available supply.

The statistics show that for the year 1945, the production of natural gasoline and all related products amounted to a total volume of 111,000,000 bbl., which we estimate to have had a composition as follows: Propane, 10,300,000 bbl.; butanes, 36,700,000 bbl.; butane-free gasoline, 61,700,000 bbl., and heavier, 2,300,000 bbl.

*President, Shamrock Oil & Gas Corp., and president, Natural Gasoline Association of America.

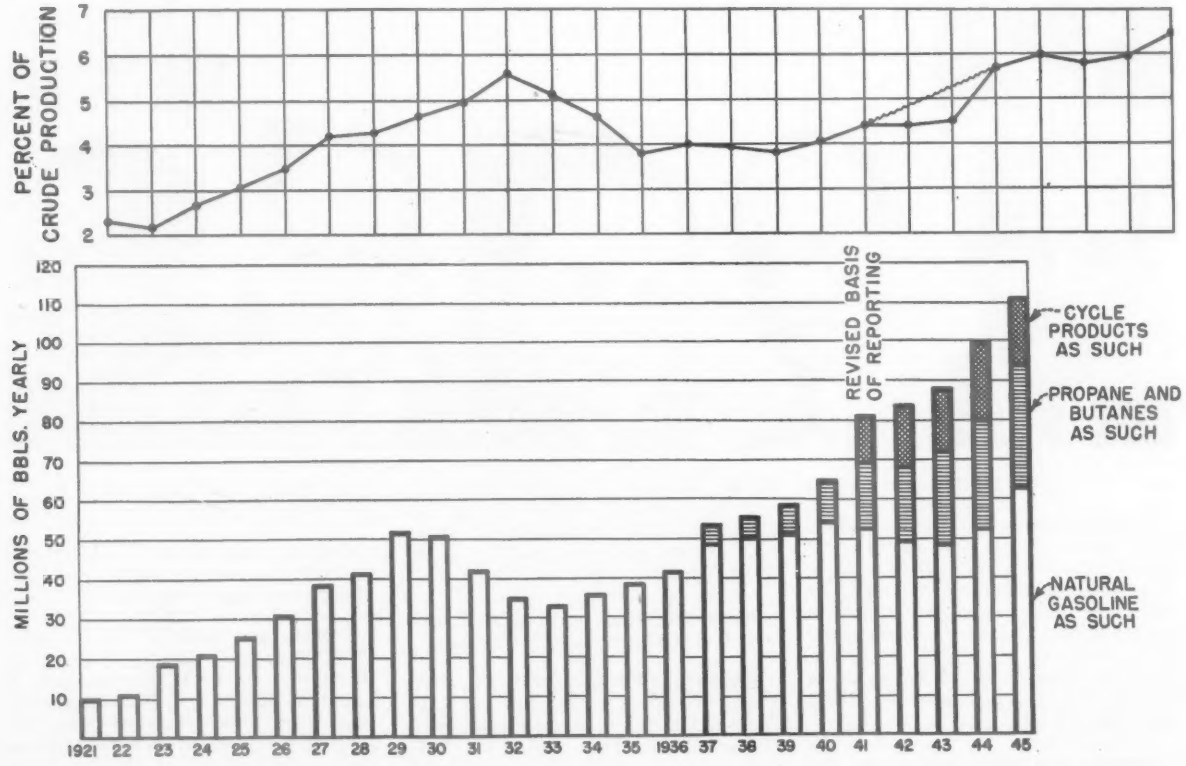


Fig. 1—Growth of the natural gasoline and allied industries, 1921 to 1946. (Source: Bureau of Mines statistics)

The foregoing figures provide an interesting analysis of our present stock in trade, and indicate the future possibilities for packaging the stock to best fit the changing markets. We still must rely upon the refiner as the principal customer for our products, but it seems we must offer something more than mere volatility. Over a period of 25 years his problem has changed from volatility to antiknock performance. The heavy gasolines of the early '20's have given place to light materials because the refiner has had to crack and reform, and now catalytically crack in order to stay in the race for antiknock quality. With every barrel of thermally cracked gasoline, there is produced 2.8 gal. of butanes in excess of average vapor-pressure requirements. The corresponding figure for catalytic cracking is 6.7 gal. With more and more cracking, so that over 50 per cent of the nation's postwar motor fuel will consist of cracked material, it is easy to see that refiners collectively will have a big supply of butanes. The light straightrun gasolines and the butane-free naturals will have no room for blending additional butane. Reliable estimates indicate that under present refining practices the potential surplus of butanes from refinery sources alone will, during the next few years, average 50,000 bbl. per day. This is over and above the production from our industry.

Our problem, therefore, is to find out what can be done with the butanes which we fractionate from our natural gasoline and which the refiner normally will not need for volatility. This brings me to one really bright spot in our future. In the period 1937 to 1945, inclusive, the volume of LPG sales has increased more than seven-fold (Fig. 2). This increase does not include large volumes used for synthetic rubber and aviation fuel. There was a steep rate of increase during the war years but this increase was in spite of, rather than because of, the war, as wartime limitations prevented an even greater expansion of the industry. As steel becomes more readily available in the future, it is not unreasonable to predict that within the next 5 years the total volume of LPG sales will increase 100 per cent over present levels of 1,100,000,000 gal. annually.

All Phases of LPG

With good fractionation in our plants, we can serve all phases of the expanding LPG business. Not only can we produce suitable domestic fuels which will bring better living standards to rural homes, but we can produce industrial fuels and chemical raw materials. We should not overlook the needs of an important sister industry, namely, natural gas. This offers great possibilities for expanding markets. Most of the large natural-gas transmission systems are confronted with increasing demands beyond their capacities, and with the further rapid decline of gas supplies in the Appalachian and Great Lakes states, this shortage of capacity, in certain instances, will become even more acute. Already some of these lines are finding it expedient to increase their capacity by enriching the gas stream with propane or propane and butane mixtures. With many natural-gas rate schedules and contracts based on total heating values, this practice will probably be expanded. Further, the natural gas distributing companies are confronted with peak demands beyond the capacity of their lines, and either they or their large industrial customers are in many cases installing propane-butane standby equipment to handle such peak demands. Obviously, then the natural-gasoline industry stands between natural gas on the one hand, and liquid petroleum products on the other hand. There is no reason why we should not look both ways in seeking outlets for those of our products which, under certain conditions, may be either gas or liquid.

I have already shown how the refining industry collectively will have a potential surplus of volatility in the next few years. We can channel our butanes along with propane into expanding LPG markets, and our chances of selling our products to the refiner should be much better if we can offer for his use a butane-free gasoline. In other words, we must offer something besides volatility. Through special fractionation we can offer the refiner isopentane which will improve both volatility and antiknock performance, and is especially needed for the manufacture of aviation gasoline.

Assuming now that we are to have markets for propane, butane, and at least some of our isopentane, we must then look for ways to dispose of the remainder. Deisopentanized natural for ordinary blending is a case in point. Most natural-gasoline fractions are superior to normal refinery fractions in lead response. This superiority can be enhanced by the use of the comparatively new desulfurization processes. To illustrate with a specific example, a certain 10-lb. deisopentanized natural sweetened by conventional methods shows a lead response of 6 octane numbers for 1 c.c. per gallon and 12 octane numbers for 3 c.c. per gallon. The same material, desulfurized, shows an increase of 10 octane numbers for 1 c.c. and 18 octane numbers for 3 c.c. per gallon.

We have long contended we could, if forced to do so, enter the finished motor-fuel market. We are in a better position to take this course than ever before, and some plants now can do it with relative ease. Others may be forced to arrange for blending stocks for use with their butane-free natural gasoline in order to obtain through the direct sale of motor fuel a satisfactory market. The cycle-plant operator is even better situated to go direct to the motor-fuel market, if necessary, because his stocks usually can be converted to a high-quality finished motor fuel by fractionating, and it is not necessary for him to make outside arrangements for blending stocks, (Table 1).

These gasolines are not conventional in the sense that they do not conform to the usual specifications written by refiners. However, many of us know from experience that these

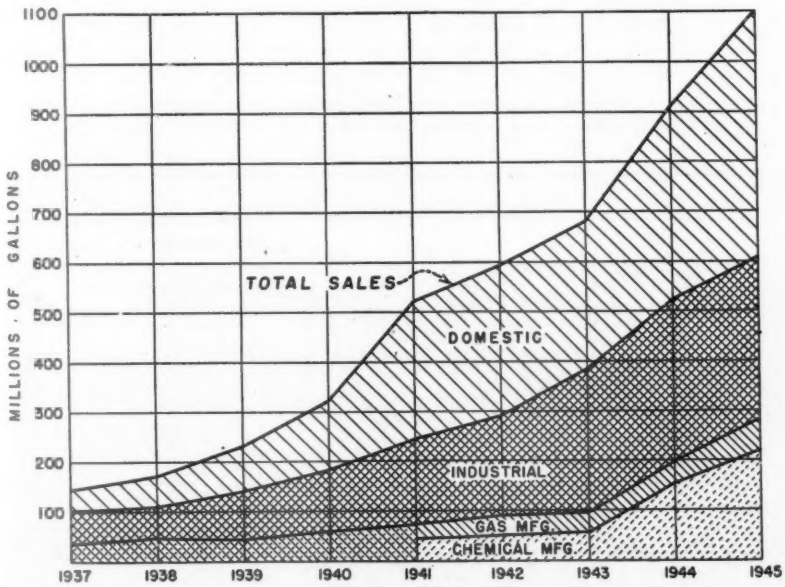


Fig. 2—Chart of LPG sales statistics. (Data from Bureau of Mines statistics)

TABLE 1—QUALITY MOTOR FUELS FROM NATURAL-GASOLINE SOURCES

	1 30%, 10 lb. natural plus 70% cracked naphtha (desulfurized)	2 Cycle stock A	3 Cycle stock B
Gravity °A.P.I.	63.4	64.9	68.7
Vapor pressure—Reid	7.4	7.5	8.0
A.S.T.M. distillation °F—			
I.B.P.	118	113	106
10 per cent rec.	140	140	136
20 per cent	154	149	149
30 per cent	168	160	164
40 per cent	186	175	185
50 per cent	214	189	206
60 per cent	242	204	231
70 per cent	268	221	259
80 per cent	312	248	293
90 per cent	354	281	328
E.P.	398	367	386
Recovery per cent	98	97	98
Loss per cent	1.0	2.0	1.0
Octane No. A.S.T.M.—			
— Clear	61.4	67.0	59.0
+ 1 ml. TEL/gal.	70.8	76.0	70.0
+ 2 ml. TEL/gal.	74.5	81.0	76.9
+ 3 ml. TEL/gal.	76.3	...	79.4

fuels can be marketed with good consumer acceptance. Indeed the problem of maximum volatility is one which might well be further investigated by this industry. We should have down-to-date information on the maximum fuel volatility limits of later-model cars, and particularly with respect to highly volatile butane-free blends. In short, we need to study, and I mean by an adequate program of road tests, not the present-day conventional refinery products, but the sort of finished motor fuels that can be made from our light materials. If we are forced to compete with the refiner we must be in position to refute any inference that our so-called "unconventional" fuels are not good fuels.

Among the various wartime processes used in the manufacture of aviation gasoline, perhaps the most important, and the one which seems most likely to survive under competitive peacetime conditions, is alkylation. It is expected that the present limited demand for isobutane for this purpose will increase with the normal expansion of the peacetime aviation-gasoline market. Under certain conditions, alkylate may also be used in motor fuel. The natural-gasoline-plant operator who finds it to his advantage to consider the installation of alkylation facilities can produce the necessary unsaturates by thermal or catalytic processing of normal butane. Though alkylation and the related operations may be applied in only a few cases, such applications will tend to eliminate surplus volatility and to effectively contribute to the balancing of supply and demand.

That such a balancing of supply and demand is urgently needed becomes obvious when we review the price fluctuation of our industry (Fig. 3). I think it safe to say that no petroleum product has had to suffer the erratic and wide variations of price that have been the lot of nat-

(Continued on page 127)

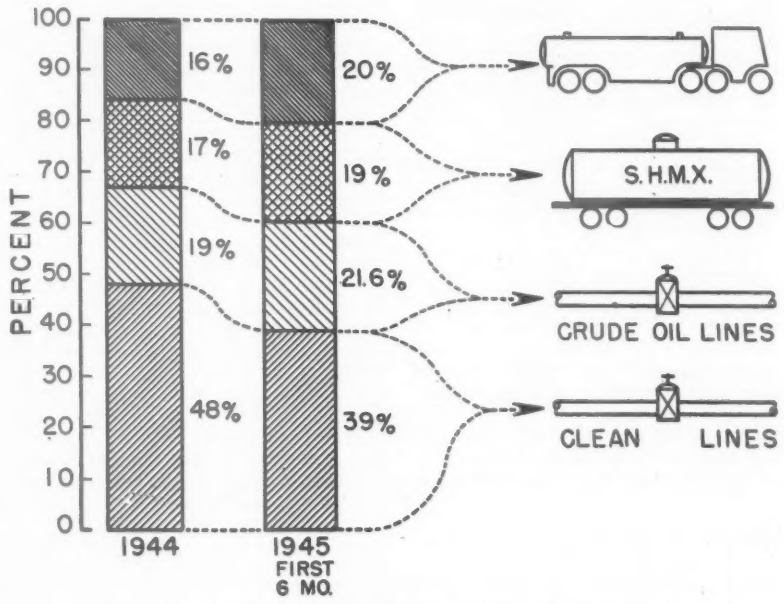


Fig. 4—How natural gasoline and allied products were transported in PAW Districts 2 and 3 during the latter part of the war period

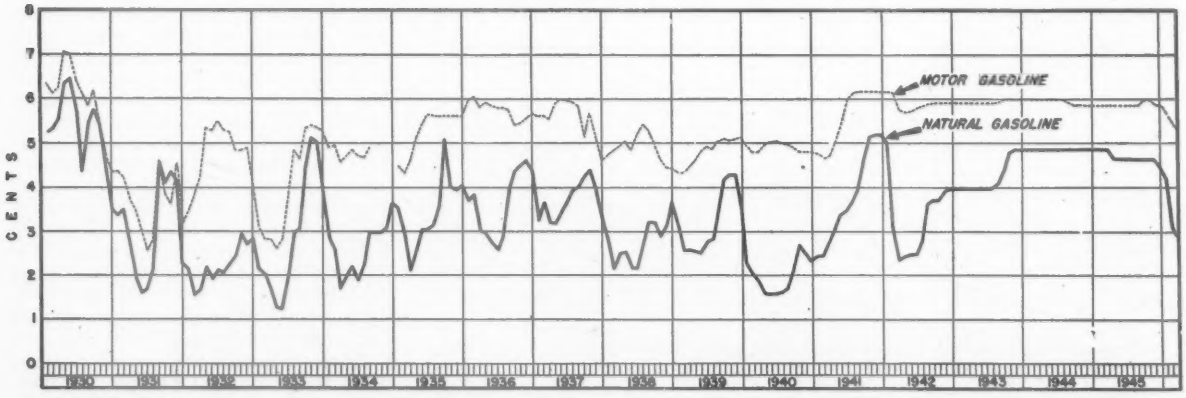


Fig. 3—Natural-gasoline and motor-gasoline prices, monthly averages. Natural, Group 3 market 26 lb. or equivalent basis. Motor, Midwest T. C. market regular grade. Compiled from Platt's Oil Price Handbook

Internal Tubing Caliper Measures Extent and Location of Corrosion

by Preston E. Chaney

The Chaney-Barnes tubing caliper may be calibrated to measure the depth of corrosion pits, as well as the internal diameter of the tubing joint with an accuracy of ± 0.01 in.

Three wells surveyed with the caliper have been worked over because of corrosion damage indicated by the caliper survey. A visual inspection of the tubing from these wells was in close agreement with the caliper survey record in each case.

The author, who is with Sun Oil Co., at Beaumont, presented this article at this week's meeting of the Natural Gasoline Association of America, at Dallas.

THE problem of internal corrosion in the tubing and well-head fittings of gas-condensate wells has become a matter of great importance to the gas-producing industry.

In recent years, corrosion has been responsible for the failure of numerous tubing strings, and in a few cases has caused complete loss of the well.

The appearance of this new corrosion problem suggested the need for some means of measuring the extent and location of corrosion damage in gas-well tubing which did not involve killing the well and pulling the tubing for a surface inspection. Work undertaken in Sun Oil Co.'s Beaumont division laboratories, toward the development of a tool for this purpose has led to the production of the Chaney-Barnes tubing caliper.

The caliper is entirely mechanical, and is adapted to be run into the tubing on a measuring line, using equipment similar to that required for bottom-hole pressure and sampling operations.

Calipering Mechanism

Referring to Fig. 1, just below the fishing neck and swivel is the calipering mechanism proper. Calipering is accomplished by means of six or more independently operating lever arms, to the outer end of which are attached small wheels or rollers to contact the tubing wall. Each lever arm is provided with a spring to urge the feeler wheel outwardly against the tubing wall. The inner arms of the six levers contact a polished steel plate on the end of the stylus rod, and it may be seen that the stylus is driven downward when-

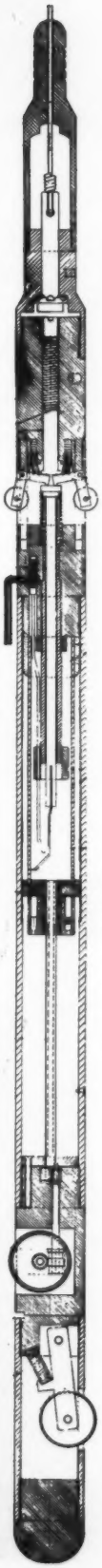


Fig. 1—(Right) Sectional view of the Chaney-Barnes tubing caliper which reveals method of operation

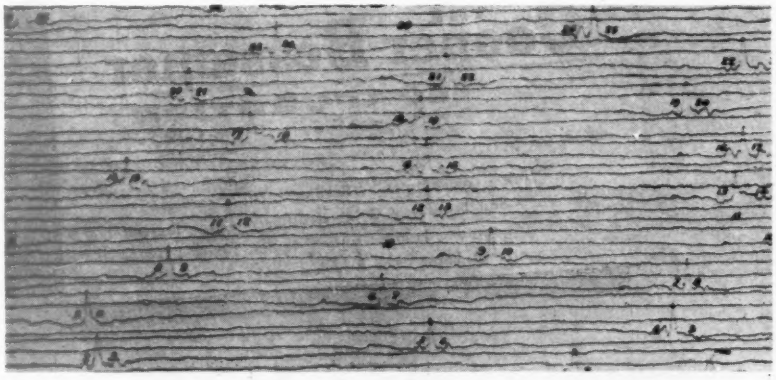


Fig. 2—(Left) The caliper produces relatively straight and parallel chart lines for uncorroded tubing. The "peaks" represent tubing couplings, and the figures on each side therefrom are the tubing joint numbers

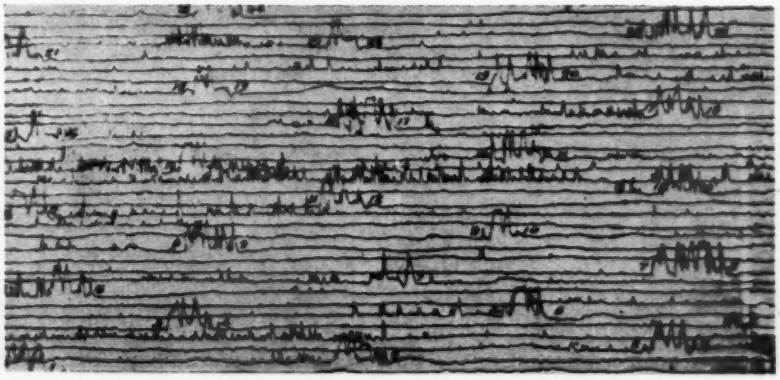


Fig. 3—Chart record of caliper survey of a severely corroded tubing string. The well is 3 Seabreeze Land. Distance between chart lines corresponds to a change in radius of the tubing of 0.05 in.

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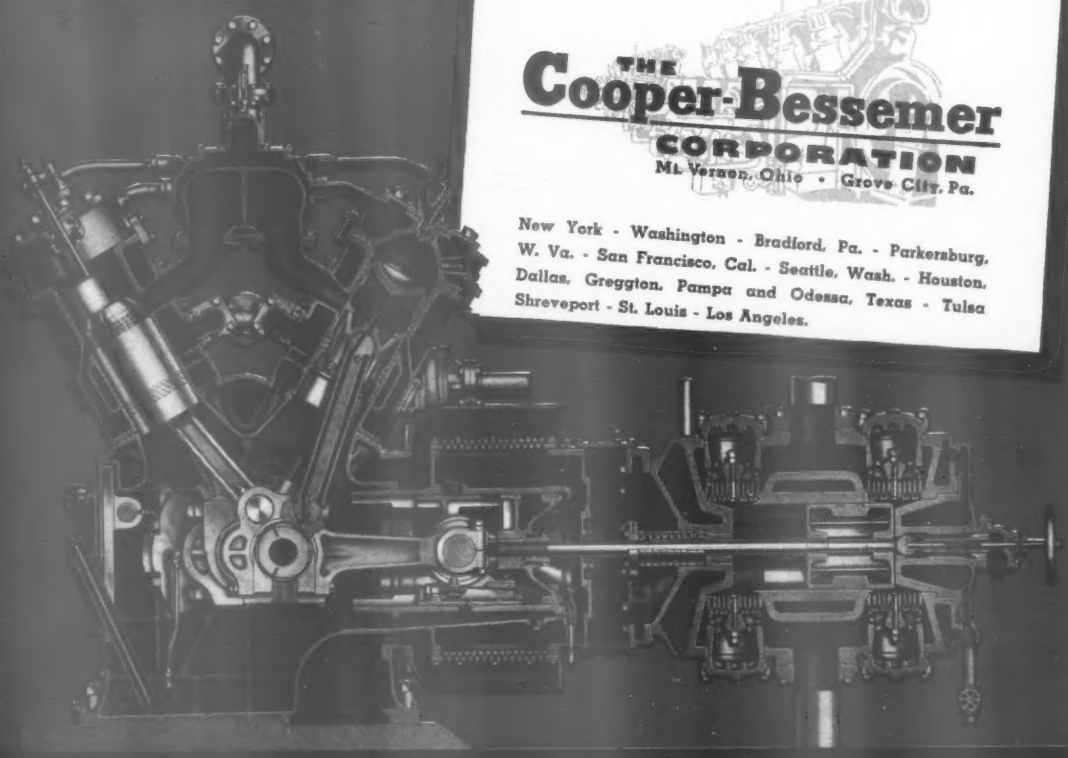

BUILDERS OF DEPENDABLE ENGINES FOR 112 YEARS

Fig. 4—Photographs of half-sections of tubing lengths from Sun Oil Co.'s 1 Wakefield, Willow Slough field, Chambers County, Texas, after 4 years' service. At left is a portion of the corresponding caliper survey

ever any one of the feeler wheels moves outwardly into a pit. In event there are several pits of varying depth about a single cross-section of the tubing wall, the stylus will be actuated by the one feeler arm corresponding to the deepest penetration of the tubing wall and will be lifted free of the other five arms. The caliper might be considered pessimistic in this respect, as it shows the minimum wall thickness at any point traversed rather than the average wall thickness at that point. However, this is an advantage rather than a disadvantage, because the safety of the tubing with respect to pressure is determined by the minimum wall thickness and not by the average wall thickness of the pipe.

Centering Mechanism

In order that the caliper may function properly, it is essential that it be centered with respect to the tubing. Centering is accomplished by means of the spring-loaded centering plug which contacts the inner arms of the feeler levers on the side opposite to the stylus mechanism. This plug is carefully ground so as to contact all the lever arms simultaneously when the instrument is properly centered in a smooth walled tube. In pitted tubing, if one lever arm moves outwardly into a pit, that lever will no longer contact the centering plug. However, the five remaining lever arms maintain contact with the plug, and serve to center the device accurately, while the sixth arm actuates the stylus to record the maximum pit depth.

Chart Drive and Recording Mechanism

With the mode of operation of the calipering mechanism in mind, we may now study the chart-drive mechanism in order to understand completely the operation of the tool.

Near the bottom of Fig. 1 will be found two wheels on opposite sides of the instrument. The lowermost of these two wheels is spring loaded, and serves only to maintain contact between the upper wheel and the tubing wall.

The upper wheel is of such diameter as to center the caliper within the tubing bore when in contact with the tubing wall. This wheel rolls against the tubing wall and, through the gear train shown in Fig. 1, causes rotation of the splined shaft between the top of the gear box and the bottom of the chart chamber.

The inner wall of the instrument case is threaded to receive threads on the upper end of the chart chamber so that, as the chart chamber is rotated by the movement of the instrument through the tubing, it is also caused to advance along this thread. In practice the chart, which consists of a coated sheet of metal foil, is inserted into the chart chamber, and the chamber is screwed into the case until the bottom of the chart chamber contacts the stop pin shown in Fig. 1, just above the gear box and in the right-hand wall of the outer case. With the chart chamber in this position, the instrument is assembled and run in the hole.

In going down the hole, the motion of the gear train tends to screw the chart chamber further into the outer case, which is of course prevented by the stop pin. Hence the chart chamber does not move in going into the hole, and the ratchet mechanism shown at the bottom of the chart chamber operates to prevent locking the gear train.

When the lowest point to be calipered has been reached, the instrument is pulled out of the hole at a rate not exceeding 100 ft. per minute. The direction of rotation of the gear train is now reversed, so that the chart chamber begins to rotate and to advance along the threaded connection.

Assuming a perfectly smooth walled tube, it will be seen that this motion of the chart chamber would cause the stylus to scribe a spiral line upon the chart material, corresponding in pitch to the pitch of the thread connecting the chart chamber with the outer case. This spiral, upon removing the chart for inspection, would be seen as a series of parallel lines on the chart face. However, any pits in the tubing wall will cause longitudinal motion of the stylus, and so produce deviations from the straight and parallel nature of these lines. The magnitude of these deviations may be read directly as the depth of the deepest pit at that particular point. These charts can best be understood by reference to Fig. 2, a caliper log on a relatively new and uncorroded tubing string, and to Fig. 3, a caliper log on a severely corroded string of tubing.

Absence of Packing Glands

There is one additional feature of this instrument which should be noted. The caliper is entirely free of packing glands. The full well pressure is freely admitted to all parts of the caliper mechanism, including the chart chamber. The chart is provided with a special oil and water resistant coating to permit logging in the presence of these fluids.

The elimination of packing glands, with their inherent frictional lag, permits the stylus to follow more closely the motions of the feeler arms, so as to provide a more accurate record of small variations in

Absorber Pressure Increase of 200 Lb. Reduces Repressuring Horsepower 37%

by Henry N. Wade

ALONG with the development of the Natural Gasoline Association of America the science of absorption of gasoline from natural gas has come a long way during the past 25 years. At the time of the formation of the association, absorption plants were almost entirely low-pressure affairs, treating gas at pressures around 30 to 45 lb. gage pressure. A very few plants operated on gas entering some of the very earliest transmission lines, at pressures around 300 lb., ranging up to as much as 500 lb. in one or two instances. Large long-distance transmission projects were still far in the future, so that there was no reason for treating gas at the high pipeline pressures which have now become conventional. Further than this, none of the deep, distillate-type producing formations had been discovered, and if they had been it is doubtful whether anyone would have thought of processing the gas at really high pressures, since the idea of pressure maintenance or recycling was not to develop on any commercial scale for another 10 to 15 years.

At time went on, the development of high-pressure natural-gas sources, combined with high-pressure transmission lines, led necessarily to the development of plants to process the gas at line pressure. This type of development culminated, as far as the author knows, in the design and construction of the Fritch, Texas, natural-gasoline plant of Texoma Natural Gas Co. This plant was designed for an operating pressure of 800 psi. at least 30 per cent higher than any used up to that time. It was also designed for what was then an extraordinarily large volume of gas in one plant: 200 million standard cubic feet per day.

The Fritch plant held its place as the highest-pressure absorption plant until about 1937, which marks the beginning of the development of Gulf Coast distillate production combined with reinjection of the stripped gas. From this time on, the absorption pressure in such plants has risen rapidly to such an extent that now absorber operating pressures in the range of 1,500 to 2,000 psig. are more or less an every-day matter.

General Factors Affecting Absorber Pressure

The ceiling of approximately 800 lb. absorption pressure for pipe-line plants was set by the limitations in the design of the pipe lines themselves. Taking into account all of the factors affecting the manufacture of the pipe itself and its handling and field fabrication into a pipe line, the most economical answer for long lines and large quantities of gas dictates maximum operating pressures in the neighborhood of 800 psig. The comparatively recent development of absorption plants operating at pressures up around 2,000 psig. has developed from the necessities of recycling or pressure-maintenance operations.

Obviously it is necessary to allow some margin between initial producing well-head pressure and the absorber pressure in order to provide for pressure drop in the extensive gas-gathering pipe system, and for cooling and controlling the flow of gas before its entrance into the absorption system. The spread in pressure between the maximum producing well-head pressure and the absorber pressure must also be large enough to enable the weakest producing well to deliver its quota of gas into the gathering system. This requires that there must be some throttling of pressure at the well head on those producing wells which have the highest producing pressures. Finally, some allowance must be made for the eventual decline of producing-well pressure which will result in time from the withdrawal from the formation of the gas volume equivalent of the liquid hydrocarbons produced by the extraction plant, plus whatever net dry gas volume is permanently removed from the structure for use as fuel at the plant and in the field operation, or for delivery to pipe lines.

How much of an allowance should be made for this unavoidable decline in pressure obviously can be determined only through a study of all of the factors surrounding the operation of the property. If a relatively short life is expected, the spread between initial producing well-head pressure and absorber pressure should be made great enough to permit operation of the plant for perhaps half of the life of the field before extensive changes will be required to allow operation at the depleted pressures which will exist toward the end of the life of the field. On the other hand, if the gas reserves are large enough to show an expected life of say 20 years or more, the absorber pressure should be just as close to the producing pressure as satisfactory load division between the

Henry N. Wade of Stearns-Roger Mfg. Co. is a graduate mechanical engineer from Cornell. He has been a leader in the design of facilities for carrying out large-scale, high-pressure cycling and gas-injection projects throughout the country. He designed the first commercial high-pressure natural-gas dehydration plant, using a solution of calcium chloride. In 1937 he designed and put into operation the first commercial natural-gas dehydration units using diethylene glycol. He has written a number of articles discussing the engineering of these types of units, also has designed a large number of natural-gasoline-recovery plants, especially in California.

CONSIDERATION of the "retrograde evaporation" of absorber oil into the dry gas leaving the absorber top has discouraged use of pressures higher than about 2,000 psig. in absorption plants. This oil loss may range from 0.06 gal. at 3,000 psig. to 0.14 gal. at 4,000 psig., may be reduced by use of a higher molecular weight oil.

In short-lived gas fields absorption pressure should be considerably higher than that of the producing formation, enough to permit operating the field for half its life before changes in the plant system are necessary. In fields promising long life, absorber pressure should be as near that of the producing formation as practicable. Relative absorbability of butane in oil between 1,000 and 2,000 psig. is reduced in inverse ratio to the change in K values, which is about 25 per cent in this pressure range.

This article was presented as a paper at the Dallas meeting this week of the Natural Gasoline Association of America.

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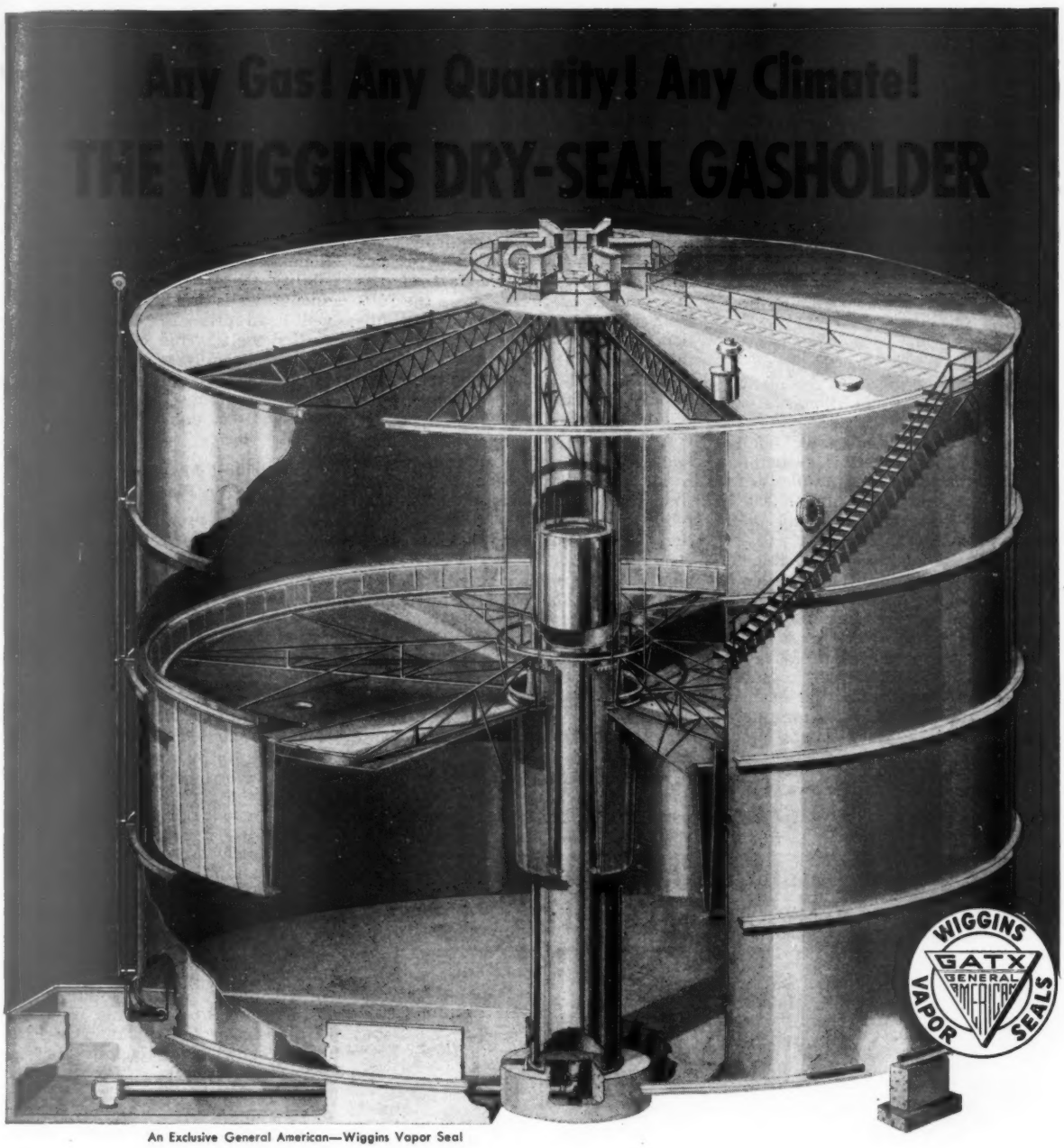

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producing wells will permit. In a long-lived property the rate of pressure decline will be slow and there will be ample time to pay out the initial investment and to plan suitable plant modifications or additions when the necessity for them arises through pressure decline.

In a typical large system of this kind the produced gas arrives at the well heads at a pressure around 2,400 psig. Experience in this field has shown that the injection pressure must be about 3,500 psig. in order to deliver a satisfactory volume back into the formation. The field piping system was designed so that the overall pressure drop from the most remote producing well into the plant is about 100 lb. An additional allowance of about 100 lb. was made for control of the individual well deliveries into the gathering system, so that the gas arrives at the plant at a pressure of about 2,200 lb., or 200 lb. below the average producing well-head pressure.

In order to make a reasonable allowance for the eventual decline of the producing pressure, the absorption system was designed for an absorber operating pressure of 1,800 psig. Thus the producing pressure can decline 400 lb. before it will be necessary to even consider any changes or additions to the plant as originally constructed.

Effect of Absorber Pressure on Compressor Horsepower

It is obvious that on a recycling system it is desirable to set the absorber pressure as high as the producing conditions will permit, in order to keep the compression ratio required for injection of the residue gas as low as possible. In the case of the recycling system just referred to, the pressure required on the injection gas at the plant headers is 3,500 lb. With the absorbers operating at 1,800 lb., this corresponds to a compression ratio of 1.94, requiring compressor horsepower of about 42 per million standard cubic feet of gas injected per 24 hours. Since the full-load capacity of the plant is 210 million standard cubic feet per 24 hours, this calls for a total compressor horsepower of 8,820, neglecting the effect of deviation on the actual horsepower requirements.

If an absorber pressure of 2,000 lb. had been chosen, the compression ratio would have been 1.74, corresponding to a compressor horsepower requirement of about 36 hp. per million. Under this condition the total compressor horsepower required would therefore have been 5,460, neglecting deviation. Thus the higher absorber operating pressure would have resulted in a saving of 2,360 compressor horsepower, neglecting deviation. Under the assumed operating conditions the deviation would amount to about 15 per cent, so that the actual saving would be about 2,000 hp.

This saving in compressor horsepower would have shown an investment saving under present installation costs of about $400,000. On the other hand, the margin allowed for field pressure decline would have been reduced to only 200 lb. This margin was felt to be entirely too small to give reasonable assurance of meeting all of the requirements. This feeling was accentuated by the fact that the boundaries of the field had not been entirely determined at the time the plant was built, and consequently it was necessary to allow some additional margin to take care of the possibility that some of the later producing wells might show producing well-head pressures lower than the earlier wells. This condition would, of course, require a general reduction in the operating pressures in the field gathering piping in order to permit such wells to deliver their allotment of gas.

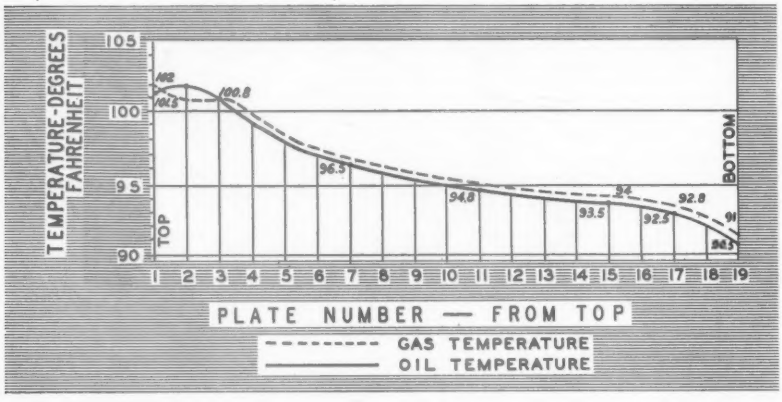
Effect of Absorber Pressure on Plant Cost

During the preliminary figuring in connection with the recycling system discussed, a set of calculations was made to determine the effect of various absorber pressures on the cost of the gasoline plant itself. These figures covered the range of absorber pressure from 1,100 to 2,000 lb. Since the plant was required to give a combined butane production efficiency of 80 per cent, the calculations were carried through using this butane efficiency as the criterion for determining the required rate of oil circulation in the plant. Somewhat to the surprise of the engineers making these calculations it was found that the total plant lean-oil circulation was almost constant over this entire range of pressure.

The explanation for this apparent paradox lies in the fact that, upon entering the top plate of the absorber, the lean oil almost instantaneously absorbs a very large amount of the residual light components remaining in the gas at that point. The actual figures showing the magnitude of this absorption are given later in a discussion of the absorption system in this plant.

For each mol of absorber oil entering the top of the 1,800-lb. absorbers in the plant there is absorbed practically instantaneously 0.91 mol of methane, ethane, and propane. The combination of absorber oil and components dissolved out of the gas then leaves the upper plate or two as a liquid with a molal quantity of about 191 per cent of the molal quantity of lean oil entering the absorber. The fact that the gain in mols of the absorbent is derived principally from the dry gas itself does not in any way affect its efficacy in absorbing heavier components from the gas in the lower plates of the absorber.

Since the extent of this inflation of the absorber oil volume is almost directly proportional to the absolute pressure in the absorber, it follows



Lean oil to absorber	94° F.
Fat oil from absorber	90° F.
Wet gas to absorber	86° F.
Dry gas from absorber	102° F.
Absorber pressure	1210 psig.
Oil-gas ratio on wet vol., g.p.m.	3.41
Oil mol wt. approx.	210

	Gas Analysis—Wet	Gas Analysis—Dry	Fat Oil—Inc. pre-absorption condensate
C_1	95.14%	95.47%	28.67%
C_2	1.61	3.05	2.89
C_3	1.24	0.96	3.95
iC_4	0.37	0.21	2.03
nC_4	0.37	0.25	2.75
iC_5	0.46	0.06	2.48
nC_5	0.81	....	1.90
C_6	....	....	4.21
C_7+AO	....	....	51.12

All analyses in mol per cent.

Fig. 1—Temperature relationships on plates in a high-pressure absorber

that, with a given external lean-oil-to-gas ratio, the actual internal oil-gas ratio increases with the pressure enough to compensate approximately for the increase with pressure in the K factors of the heavier components which it is desired to extract, at least over this range of pressure.

Taking normal butane as an example, and assuming an effective absorber temperature of 110° F., the K chart values for methane and butane at 1,000 and 2,000 lb. are as follows:

K FACTORS AT 110° F. EFFECTIVE TEMPERATURE

Component—	At 1,000 lb.	At 2,000 lb.	Per cent change
Methane	4.4	2.7	*63
Butanes	0.192	0.240	†25

*Decrease. †Increase.

The K value of methane at 1,000 lb. is 4.4, whereas it is 2.7 at 2,000 lb. Since the amount of methane absorbed in a given amount of absorber oil is, on the first approximation, inversely proportional to these K values, the top-plate absorption of methane at 2,000 lb. would be 1.63 times its absorption at 1,000 lb.

Referring now to the K values for an average mixture of butanes, the K at 1,000 lb. is 0.192 and at 2,000 lb. 0.240. In other words, in this range of pressure the butane is behaving in the so-called "retrograde" manner. Putting this another way, the increase in pressure reduces the relative absorbability of the butane in the inverse ratio of the K values. In the case of the butane K's this change amounts to 25 per cent.

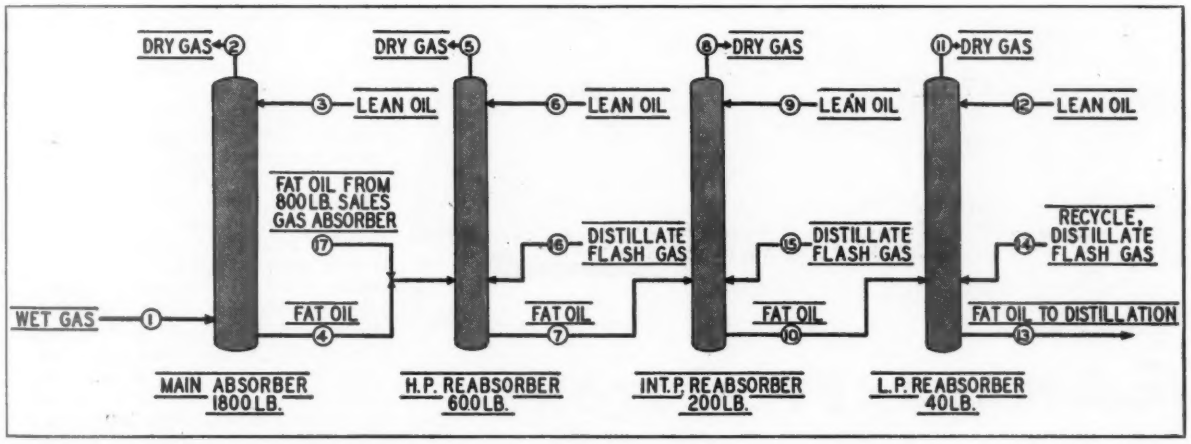
Putting these factors together, if the effective internal absorber oil stream at 1,000 lb. is taken as 100 per cent, the increase in the stream due to increase in pressure will make the effective internal stream 163 per cent at 2,000 lb. However, in order to balance the decrease in absorbability of the butanes over this same pressure range an increase in internal oil rate of only 25 per cent would be necessary. Thus, as far as the absorption of butanes only is concerned the increase in pressure increases the internal oil rate faster than is really necessary. The proportionate increase in K factors is greater for the heavier components, and consequently the net effect of combining all of the factors proves to require a slightly higher external circulation of oil at 1,000 lb., with a minimum at about 1,400 lb., followed by a gradual increase up to 2,000 lb. The difference between the maximum and minimum oil circulations required for equal butane extraction was less than 10 per cent over the entire range between 1,000 and 2,000 lb. absorber pressure.

The inflation of the lean oil entering the absorber through absorption of methane and ethane near the top plate is illustrated directly by the absorber temperature curve shown in Fig. 1. This curve and the data accompanying it show the performance of an absorber in a South Texas field operating at a pressure of 1,210 psig.

Inspection of this curve shows that although the absorber oil enters the top of the absorber at 94° F., and the gas enters the bottom of the absorber at 86° F., the temperature of the oil and gas on and between the upper plates rises to a maximum of 102° on plate No. 2, numbering from the top. The temperature then declines more or less regularly to the bottom of the absorber, where the oil and gas on the last plate both have a temperature of about 5° above the temperature of the incoming gas.

The abrupt rise in temperature at the top of the absorber reflects the effect of the heat of absorption of the dry gas as it dissolved in the lean oil. The amount of this absorption at this point is much greater than the absorption going on in any other part of the column and consequently the temperature produced is a maximum here. As the oil proceeds down through the absorber it is gradually cooled off by heat exchange against the relatively cool incoming gas.

The difference in temperature between the incoming wet gas and the bottom plates reflects the absorption



Comp.—	Mols per day (1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
C_3	558,468	521,628	.....	36,850	25,403	.....	14,717	11,405	.....	4,380	5,085	.....	697	1,281	1,199	722	2,548
C_3	28,041	21,641	.....	6,400	1,516	.....	5,548	1,485	.....	4,075	3,427	.....	2,586	1,800	150	45	619
C_4	11,700	6,320	.....	5,380	391	.....	5,676	437	.....	5,130	1,793	.....	5,082	1,577	59	16	671
IC_4	2,195	521	.....	1,674	32	.....	1,858	37	.....	1,775	148	.....	2,017	335	9	3	213
NC_4	3,123	338	.....	2,785	14	.....	3,135	26	.....	3,032	50	.....	3,495	425	11	3	361
IC_5	1,294	1	.....	1,293	0	.....	1,417	0	.....	1,399	0	.....	1,514	94	3	1	123
NC_5	795	0	.....	795	0	.....	862	0	.....	853	0	.....	911	47	2	1	66
C_6	1,893	0	.....	1,893	0	.....	2,000	0	.....	1,993	0	.....	2,048	46	2	1	106
F_1	954	.....	.....	954	.....	.....	998	.....	.....	998	.....	.....	1,012	13	1	0	44
F_2	1,473	.....	.....	1,473	.....	.....	1,508	.....	.....	1,508	.....	.....	1,510	5	1	0	35
F_3	88	.....	.....	88	.....	.....	88	.....	.....	88	.....	.....	88	0	0	0	0
F_4	6	.....	.....	6	.....	.....	6	.....	.....	6	.....	.....	6	0	0	.....	0
AO	.....	.....	53,209	53,209	.....	2,898	65,351	.....	2,721	65,351	.....	13,398	81,470	0	0	.....	9,244
Total	610,030	550,439	53,209	112,800	27,356	2,898	103,164	13,390	2,721	90,588	10,503	13,398	102,440	5,623	1,437	792	14,030

Fig. 2—Absorber-reabsorber system and the flashing of light products from fat oil prior to distillation

by the oil of the heavier components from the wet gas. However, the temperature rise produced by this absorption is almost completely masked by the effect of the large absorption of methane near the top of the absorber.

It is interesting to note that the general shape of this temperature curve is the opposite of that usually encountered in low pressure absorption. At pressures of 300 lb. or below the methane absorption, while appreciable, is not enough to produce any sharp rise in temperature near the top of the column. In low and moderate-pressure absorbers most of the heat of absorption is derived from the heavier or "gasoline" components of the wet gas. Since this absorption occurs largely on the first few plates above the bottom of the absorber, the sharp temperature rise takes place near the bottom and the temperature then gradually declines as the gas passes upward through the plates to the top.

The actual figures showing the relationship between lean oil, dry gas, wet gas, and fat oil quantities and compositions are shown in Fig. 2 diagram of the fat oil absorption and venting system in the plant under discussion.

The wet gas (1) enters the main absorbers at a pressure of 1,800 psig., in the total quantity of about 610,000 mols per 24 hours. The dry gas (2) amounts to 550,000 mols. The difference of 60,000 mols is made up of about 43,000 mols of methane and ethane dissolved in the fat oil, which must eventually be removed in the venting and fractionating system, and 17,000 mols of propane and heavier components out of which the production of the plant is derived. The absorber oil stream amounts to 53,200 mols per day, and is inflated almost immediately upon its entrance to the absorber by the total amount of methane, ethane, and propane in the fat oil. As stated above, this inflation amounts to 91 per cent of the molecular quantity of the lean oil, so that for every gallon of oil pumped into the absorber the absorbing effect is approximately doubled.

In order to make it possible to distill and condense the desired components in the fat oil stream, it is, of course, necessary largely to remove the methane and ethane before the fat oil finally enters the distillation system proper. This is accomplished by passing the oil through a series of vent tanks represented by the reabsorbers indicated in Fig. 2. Actually the flashing of the fat oil stream is accomplished in a separate vessel outside the reabsorber shell in each case.

The first flash tank and reabsorber operate at 600, the second at 200, and the third at about 40 psig. The reabsorbers are provided to control the loss of desired components in the stream of dry gas flashed out of the fat oil stream at each pressure.

In the plant under discussion a large part of the production is separated from the incoming gas after cooling and final pressure reduction of the gas to the main absorber pressure. This separated liquid contains the heavier components of the vapor from the formation, together with the connate water. The water is separated from the distillate and the distillate is then carried through three pressure reductions in the same steps as on the fat oil stream. The gas vented from the distillate stream is conducted to the corresponding reabsorbers for extraction of desirable components along with the gas flashed from the fat oil stream. Quantitative results from this operation are shown in the tables on Fig. 2.

Although the investigation of the effect of absorber pressures between 1,000 and 2,000 lb. showed only a very small difference in the external lean oil rate for 80 per cent butanes extraction, this does not mean at all that the cost of the absorption plant would not be affected by the operating pressure in the main absorbers. Practically all of the factors affecting the cost of the absorption unit are increased by increasing pres-

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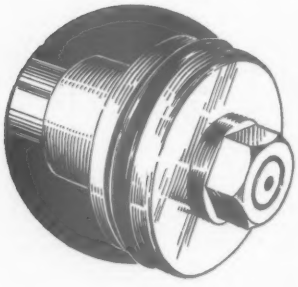

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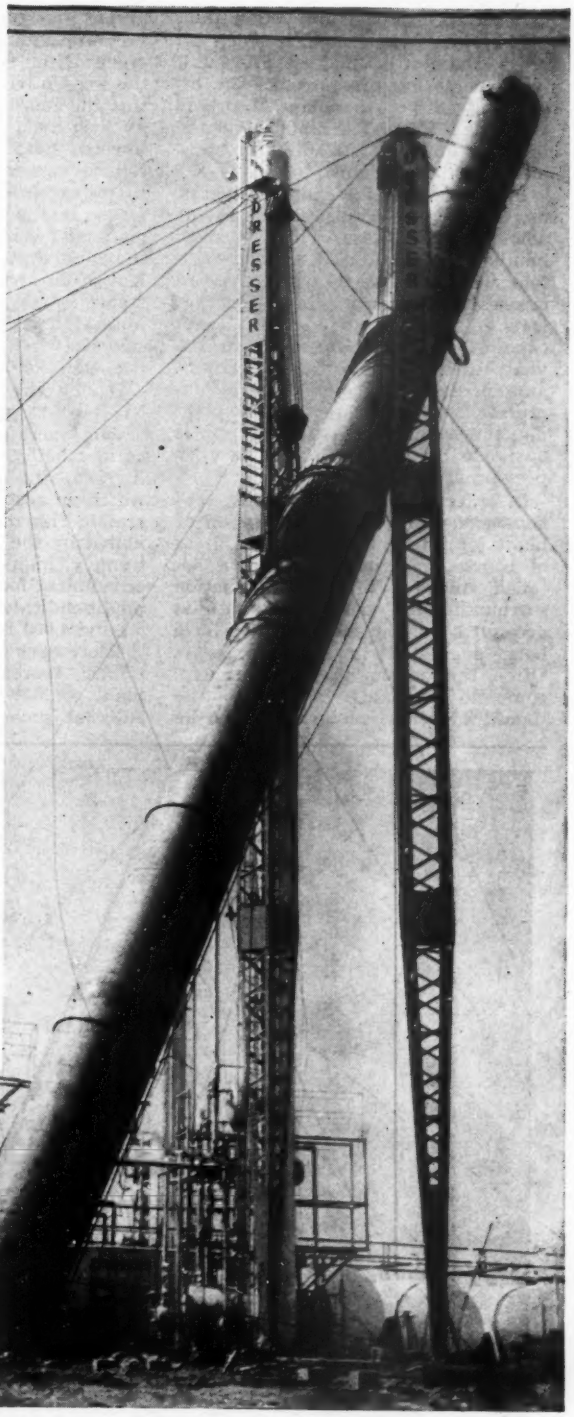

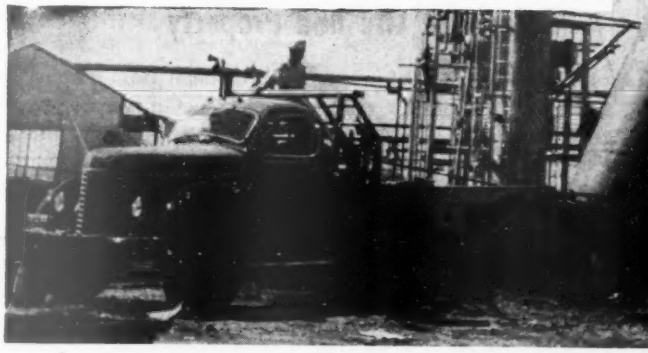

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sure, so that the saving in investment resulting from the reduction of injection compressor horsepower through the use of a high absorber pressure is partially offset by the increased cost of the absorption unit.

The two obvious factors which increase the cost of the absorption unit with increasing pressure are the increasing cost of the main absorbers with their associated piping, and the increase in cost of the high-pressure lean-oil pumping unit.

In addition to these direct factors, increasing the pressure increases the amount of vent gases which must be handled in the fat-oil venting system. This increase in vent gases increases the quantity of reabsorber lean oil required to control the escape of desired components in the vent gases, enlarges the reabsorbers, and increases the amount of recompressor horsepower required to handle the vented gases if no use is available for them at the reabsorber pressures.

In order to arrive at the most economical design of the combination of plant for injection compressors, it is, of course, necessary to make a detailed study of the entire situation surrounding the operation, taking into account all of the factors which have been suggested in this discussion. Often this means preparing several complete estimates. Such estimates should take into account not only the initial investment but the probable operating and maintenance costs of the plant and the injection compressors. It has been our experience that operating and maintenance costs per unit of investment are higher for compressing equipment than for the average of the equipment entering into the absorption plant. On account of this the most economical answer for a long-lived project should lean toward those factors which tend to reduce compressor horsepower even to the extent of some degree of increase in the total cost of absorption plant and compressors. It is obvious that a definite answer to this problem in any particular situation is affected by so many factors that it is impossible to do anything but try to suggest what some of them are, as has been done.

During the past few years there has been a good deal of discussion among operators and plant designers as to whether there is any practical limit to the maximum pressure at which an absorption plant can be operated. This discussion has been stimulated by the discovery of a few extremely high-pressure fields, where economics for a recycling system might indicate absorber pressures up around 4,000 lb.

There does not seem to be any particular reason why an absorption plant could not be operated successfully at such a pressure, except for the fact that all of the equipment would be so special that its cost would be inordinately high.

Another interesting factor which may put a practical limit on absorber pressure is the so-called "retrograde evaporation" of the absorber oil. Careful tests made on this phenomenon several years ago indicated that with an absorber oil having the characteristics listed below the loss of oil through evaporation into the dry gas leaving the absorber would be excessive at pressures much over 2,000 lb. The oil used in these experiments had an average molecular weight of 183 and an A.P.I. gravity of 32.5°. The initial boiling point was 300° F.; the 50 per cent point 411° F., and the end point 650° F. It was determined by fractional analysis that the following quantity of oil in gallons per thousand standard cubic feet vaporized into the dry gas stream at a temperature of 92° F.

Absorber pressure	Oil loss, gal./M.c.f.
1,500	0.008
2,000	0.02
3,000	0.06
4,000	0.14

It seems probable that the loss at the higher pressures could be very greatly reduced by using an absorber oil of a considerably higher average molecular weight.

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Natural-Gasoline Industry Looks Two Ways

(Continued from page 114)

ural gasoline. By way of brief review, we may first recall the prosperous '20's when prices ranged up to 12.0 cents per gallon, and when a low of about 4.5 cents in April 1927 threw consternation into the industry.

Next, we contemplate the record of the depression decade, a time when any resemblance between the price of natural, and of motor fuel, came to be purely a coincidence. This period culminated in 1940 with the Group 3 price of natural averaging less than 2 cents per gallon, well below the value of crude oil.

In 1941, under the spur of wartime demand, refiners were quick to recognize that a barrel of good aviation-base stock could be recovered from natural with less expenditure for manpower and equipment than for the same barrel made from crude oil. By the year end, natural was above 5.0 cents, Group 3, for the first time in 8 years. Now by contrast, the current market trend is very similar to 1940 conditions.

Market-Fluctuation Factors

Let us look at some factors responsible for these fluctuating markets. The greatest economic handicaps which natural gasoline has had in the past have been (1) cost of transportation, and (2) seasonal demand necessitating expensive periodic storage. Crude oil has throughout the past 25 years and longer moved to refinery markets by pipe line. On the other hand, natural gasoline has been burdened with high-cost rail transportation. (Quoted markets being based entirely upon tank-car shipments). About 8 or 10 years ago, some more enterprising refiners, partly at the insistence of their own natural-gasoline departments, started moving natural by pipe line in blend with crude oil. These refiners soon learned that the higher-vapor-pressure material could be handled without appreciable losses, and that the reduction in viscosity, in most cases, increased the total capacity of the pipe line so as to, in effect, give the natural gasoline a "free ride." The only charge to be made against the saving in transportation cost is, therefore, the negligible cost of handling the extra material through the primary distillation process at the refinery.

In recent years there has been an even greater development in the transport of natural gasoline in clean lines. Special lines are usually provided for the transport of natural gasoline to refining centers where production volumes are concentrated in sufficient quantities to justify such facilities. Examples of these cases are

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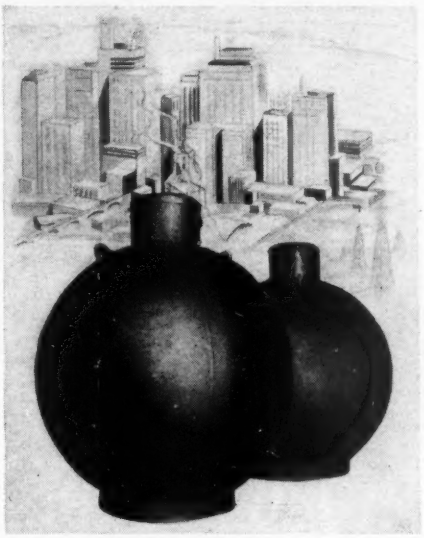

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Statistics show that during the later war years, PAW Districts 2 and 3 produced about 88 per cent of the total natural gasoline and related products produced in the United States. Statistics also show that the pipe line transportation of these products in Districts 2 and 3 increased to the extent that nearly 70 per cent of the production in these districts moved by pipe line, of which about 20 per cent was transported in crude lines and nearly 50 per cent was transported in clean lines (Fig. 4). It is significant to note that the volumes transported in crude-oil lines alone exceeded the volumes transported by tank car.

Industry Would Benefit

The increased transportation of naturals by pipe line would materially benefit the entire industry. Full benefit, however, can only come when the refiner, receiving naturals by pipe line, pays for them on a basis of their competitive value as raw materials. Even though more than 50 per cent of natural gasoline production is now moving to market by pipe line, the natural-gasoline-plant operator still receives a price based upon noncompetitive transportation by rail. In the past, the refiner's need and willingness to pay high prices for volatility on a seasonal basis had some tendency to average out the return to the gasoline plant. I must direct your attention to the importance of pipeline transportation and commodity value to our industry in the face of recent changes in the supply and demand for volatility. The trend toward greater pipe-line movement of natural-gasoline products may make it possible for the refiner to consider these products on a competitive-commodity basis. If the refiner can do this, the natural-gasoline-plant operator must stand ready to furnish products of the specifications desired. He must then develop other markets for his surplus volatility. On the other hand, if such pipe-line markets are not provided, and he is to survive in a competitive field, he must adopt some direct approach to the market.

Because of my interest in the subject I have been greatly impressed by the remarks of Col. Ernest O. Thompson, member of the Railroad Commission of Texas, which pertain to the production and utilization of light hydrocarbons, and which were part of his address on March 26, 1946, before the Western Petroleum Refiners Association in Fort Worth.

He has in his address suggested that the proper yardstick of conservation may be a total hydrocarbon balance of supply and demand. We must remember, however, that the solutions are relatively simple to state, but the balanced picture can be extremely complex to accomplish. It can only be done by intelligent application of the resources available to the individual operator. I believe that true and real conservation can be accomplished only with the full utilization of the lighter hydrocarbons produced with crude oil and natural gas. I hasten to say also that it is my opinion that when economically transported, these raw materials, on the basis of their commodity value, will yield to the producer a fair and satisfactory return.

C. E. Morlan, former superintendent of Cities Service Oil Co.'s West Texas operations, has become vice president and general manager of Patoil Corp. succeeding **Coy Hogg,** who resigned to become petroleum engineering professor at Marietta College.

M. Wiggen, veteran technical employe of Humble Oil & Refining Co., has been made a technical specialist concerned primarily with long-range development and modernization studies. **George H. Shipley** has replaced Wiggen as head of the treating section in the technical service division.

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Survey of Natural Gasoline Plants

Compiled by The Oil and Gas Journal

SUMMARY OF ACTIVE GASOLINE PLANTS—1946

	Approx. capacity, gal. per day	
	Natural	L.P.G.
Arkansas	157,500	116,000
California	3,001,100	341,000
Colorado	6,000	.....
Illinois	536,600	160,000
Kansas	246,700	153,000
Kentucky	66,000	.....
Louisiana	614,500	44,000
Michigan	20,000	31,500
Montana	25,000	.....
New Mexico	447,000	20,000
Ohio	46,900	5,000
Oklahoma	1,689,800	286,000
Pennsylvania	102,460	600
Texas	4,228,850	737,000
West Virginia	314,420	5,000
Wyoming	189,100	42,000
Total United States	11,691,930	1,946,500

ARKANSAS

Company, plant and county—	Approx. capacity, gallons per day	
	Natural	L.P.G.
Arkansas Fuel Oil Co., Dorcheat, Columbia	35,000	55,000
Barnsdall Oil Co., Midway, Miller	13,000	12,000
Lion Oil Refining Co.,* Schuler, Union	20,000	12,000
Magnolia Pet. Co., Kenova, Union	5,500	1,000
Querbes Oil Co., Helwig, Union	4,000	.....
Sam Sklar, trustee, Armstrong, Union	2,000	.....
Sam Sklar, trustee, Louann, Ouachita	3,500	.....
Sam Sklar, trustee, Pratt, Union	4,000	.....
Sam Sklar, trustee, Rainbow, Union	2,500	.....
Shell Oil Co., Inc., Magnolia, Columbia	50,000	20,000
McKamie Gas Cleaning Co., McKamie, Lafayette	18,000	16,000
Total	157,500	116,000

*Schuler unit gasoline plant.

CALIFORNIA

Company, plant and county—	Approx. capacity, gallons per day	
	Natural	L.P.G.
Bankline Oil Co., Long Beach, Los Angeles	20,000	.....
Belridge Oil Co., North Belridge, Kern	75,000	.....
Belridge Oil Co., North Belridge, Kern	75,000	.....
Coline Gasoline Co., Rincon, Ventura	20,000	10,000
Coline Gasoline Co., Torrance, Los Angeles	30,000	.....
Continental Oil Co., San Miguelito, Ventura	15,000	.....
Cowan Oil & Ref. Co., Rosecrans, Los Angeles	10,000	10,000
Del Valle Gasoline Co., Del Valle, Los Angeles	30,000	.....
Fullerton Oil Co., Huntington Beach, Orange	70,000	.....
General Pet. Corp., Helm-Riverdale	25,000	35,000
General Pet. Corp., Brea-Olinda, Orange	20,000	.....
General Pet. Corp., Boirrel, Fresno	60,000	.....
General Pet. Corp., Athens, Los Angeles	100,000	80,000
General Pet. Corp., Santa Fe Springs, Los Angeles	55,000	.....
General Pet. Corp., Wilmington, Los Angeles	60,000	.....
General Pet. Corp., Ventura, Ventura	40,000	.....
Honolulu Oil Corp., Kern	25,000	.....
Inglewood Gasoline Corp., Potrero, Los Angeles	15,000	.....
Lomita Gasoline Co., Long Beach 1, Los Angeles	85,000	.....
Lomita Gasoline Co., Long Beach 4, Los Angeles	30,000	.....
Lytle, R. S., Operator, Coalinga Nose, Fresno	40,000	.....
Magruder, P. S., Oper., Kettleman Huffman Plt.	70,000	40,000
Magruder, P. S., Oper., Western States Plt.	70,000	60,000
Norwalk Co., The, Midway-Sunset, Kern	50,000	5,000
Norwalk Co., The, Santa Fe Springs, Los Angeles	50,000	5,000
Norwalk Co., The, Signal Hill	50,000	5,000
Rice Ranch Oil Co., Orcutt, Santa Barbara	3,300	.....
Richfield Oil Corp., Coles Levee, Kern	32,000	.....
Richfield Oil Corp., Long Beach, Los Angeles	25,000	.....
Shell Oil Co., Inc., Brea-Olinda, Orange	20,000	.....
Shell Oil Co., Inc., Capitan, Santa Barbara	5,000	.....
Shell Oil Co., Inc., Dominguez, Los Angeles	25,000	.....

CALIFORNIA (Continued)

Company, plant and county—	Approx. capacity, gallons per day	
	Natural	L.P.G.
Shell Oil Co., Inc., Long Beach, Los Angeles	60,000	.....
Shell Oil Co., Inc., Ten Section, Kern	50,000	50,000
Shell Oil Co., Inc., Orcutt, Santa Barbara	2,500	.....
Shell Oil Co., Ventura, Ventura	120,000	.....
Signal O. & G. Co., Elwood 10, Santa Barbara	20,000	.....
Signal O. & G. Co., Huntington Beach 11, Orange	60,000	8,000
Signal O. & G. Co., Long Beach 2, Los Angeles	50,000	6,000
Signal O. & G. Co., Long Beach 6, Los Angeles	15,000	.....
Standard Oil Co. of Cal., Coalinga 19-B, Fresno	10,000	.....
Standard Oil Co. of Cal., Coles Levee, Kern	12,000	.....
Standard Oil Co. of Cal., Greeley, Kern	20,000	.....
Standard Oil Co. of Cal., Murphy-Coyote, Los Angeles and Orange	40,000	.....
Standard Oil Co. of Cal., Huntington Beach 4, Orange	35,000	.....
Standard Oil Co. of Cal., Inglewood, Los Angeles	30,000	.....
Standard Oil Co. of Cal., Kettleman Hills 11-P, Kings and Fresno	65,000	.....
Standard Oil Co. of Cal., Kettleman Hills 3-P, Kings and Fresno	120,000	.....
Standard Oil Co. of Cal., Kettleman Hills 33-J, Kings and Fresno	100,000	.....
Standard Oil Co. of Cal., Lost Hills, Kern	4,000	.....
Standard Oil Co. of Cal., Taft 1-C, Kern	15,000	.....
Standard Oil Co. of Cal., Taft 7-D, Kern	17,500	.....
Standard Oil Co. of Cal., Taft 29-G, Kern	15,000	.....
Standard Oil Co. of Cal., Taft 31-E, Kern	10,000	.....
Standard Oil Co. of Cal., Wasco, Kern	6,000	.....
Standard Oil Co. of Cal., Mount View 32-Z, Kern	12,000	.....
Standard Oil Co. of Cal., Santa Fe Springs, Los Angeles	40,000	.....
Standard Oil Co. of Cal., Torrance, Los Angeles	12,000	.....
Standard Oil Co. of Cal., Seal Beach, Orange	25,000	.....
Superior Oil Co., Rio Bravo, Kern	3,000	4,000
Texas Co., The, Montebello, Los Angeles	40,000	5,000
Texas Co., The, Santa Fe Springs, Los Angeles	50,000	.....
Texas Co., The, Shiells Canyon, Ventura	35,000	.....
Texas Co., The, Long Beach, Los Angeles	75,000	.....
Tide Water Asso. Oil Co., Ventura (3 plants)	130,000	.....
Union Oil Co., Brea-Olinda, Orange	22,500	.....
Union Oil Co., Dominguez, Los Angeles	69,000	.....
Union Oil Co., Kettleman Hills, Kings and Fresno	30,000	.....
Union Oil Co., Playa del Rey, Los Angeles	30,000	.....
Union Oil Co., Rio Bravo, Kern	15,000	.....
Union Oil Co., Rosecrans, Los Angeles	27,000	.....
Union Oil Co., Santa Fe Springs, Los Angeles	70,000	.....
Union Oil Co., Orcutt, Santa Barbara	15,000	.....
Union Oil Co., Santa Maria, Santa Barbara	20,000	.....
Union Oil Co., Richfield, Orange	10,000	.....
U. S. Navy Petroleum Reserve, Elk Hills, Kern	5,000	.....
Universal Consolidated Oil Co., Rosecrans, Los Angeles	8,000	.....
West Coast Ref. Co., Richfield, Orange	35,000	.....
Westates Pet. Corp., Coalinga, Fresno	300	.....
West Rosecrans Gasoline Co., Rosecrans, Los Angeles	5,000	.....
Wilmington Gasoline Co., Wilmington, Los Angeles	40,000	18,000
Total	3,001,100	341,000

COLORADO

Mountain States Oil Corp., Trinidad, 3-33s-62w	6,000	.....

ILLINOIS

Arkansas Fuel Oil Co., Illinois, Crawford	500	.....
Brenneman & MacDonnell, Condry, Crawford	1,500	.....
Carter Oil Co., The, Louden, Fayette	30,000	30,000
Engle Petroleum, Inc., The, Benton, Franklin	25,000	25,000
Engle Petroleum, Inc., The, Salem, Marion	72,000	50,000
Ohio Oil Co., The, Casey	1,200	.....
Texas Co., The, Hoodville, Hamilton	90,000	.....
Texas Co., The, Salem, Marion	190,000	.....
Warren Pet. Corp., Crossville 23, White	60,000	50,000
Warren Pet. Corp., Salem 21, Marion	60,000	5,000
Miscellaneous*	6,400	.....
Total	536,600	160,000

*Includes two plants in Crawford County operated by Cheuvront Oil Co., as vacuum plants.

KANSAS

Company, plant and county—	Approx. capacity, gallons per day: Natural	L.P.G.
Barnsdall Oil Co., Rainbow Bend, Sumner	3,500	1,000
Cities Service Oil Co., Wichita, Sedgwick	50,000	17,000
Cities Service Oil Co., Burrton and Stone, Reno	16,500	8,000
Cities Service Oil Co., Madison, Greenwood	10,000	.....
Continental Oil Co., No. 9, Cowley	25,000	.....
Edwards Gasoline Co., Zenith, Stafford	2,000	.....
Flynn Oil Co., Otis, Rush	5,000	1,000
Kansas P. & L. Co., Medicine Lodge, Barber	15,000	.....
Kansas P. & L. Co., McPherson, McPherson	15,000	.....
Northern Natural Gas Co., Hugoton, Stevens	45,000	14,000
Panhandle Eastern P. L. Co., Liberal, Seward	36,000	100,000
Phillips Pet. Co., Demalorie-Souders, Scott	3,000	.....
Phillips Pet. Co., Demalorie-Souders, Scott	1,200	.....
Skelly Oil Co., Cunningham, Kingman	13,500	12,000
Texas Co., The, Atlanta, Cowley	6,000	.....
Total	246,700	153,600

KENTUCKY

Ashland Oil & Refining Co., Fixer, Lee	4,000	.....
Kentucky-West Virginia Gas Co., Dwale, Floyd	5,000	.....
Virginian Gasoline & Oil Co., Leach, Boyd	40,000	.....
Virginian Gasoline & Oil Co., Warfield, Martin	17,000	.....
Total	66,000	.....

LOUISIANA

Anchor Gasoline Corp., Eola, Avoyelles	20,000	.....
Arkansas Fuel Oil Co., Langston, Claiborne	5,000	.....
Arkansas Fuel Oil Co., Shreveport, Caddo	15,000	1,000
Arkansas Fuel Oil Co., Bisteneau, Bienville	15,000	1,000
Arkansas Fuel Oil Co., Rodessa, Caddo	10,000	2,500
Arkansas Fuel Oil Co., Sligo, Bossier	6,000	2,500
Arkla Oil Co., Rodessa, Caddo	50,000	10,000
Carter Oil Co., The, Langston, Claiborne	5,000	.....
Carter Oil Co., The, Stiles, Caddo	5,000	.....
Claiborne Gasoline Co., Lisbon, Claiborne	60,000	.....
Coltexo Corp., Rodessa, Caddo	40,000	.....
Continental Oil Co., Gillis, Calcasieu	20,000	.....
Continental Oil Co., Tepetate, Jefferson Davis	20,000	.....
Continental Oil Co., Ville Platte, Evangeline	100,000	.....
Glen Rose Gasoline Co., Rodessa, Caddo	20,000	.....
Great National Oil Corp., Ida, Caddo	35,000	.....
Gulf Refining Co., Homer, Claiborne	7,500	.....
Haynesville Operators, Haynesville, Claiborne	35,000	13,000
Ohio Oil Co., The, Haynesville, Claiborne	2,000	.....
Shell Oil Co., Inc., Iowa, Calcasieu	29,000	.....
Skelly Oil Co., Rodessa, Caddo	6,000	.....
Stanolind Oil & Gas Co., Pine Island, Caddo	4,000	.....
Texas Co., The, Lafitte, Jefferson	6,000	.....
United Gas P. L. Co., Cotton Valley, Webster	20,000	5,000
United Gas P. L. Co., Koran, Bossier	18,000	5,000
United Gas P. L. Co., Rodessa, Caddo	50,000	2,000
United Gas P. L. Co., Sugar Creek, Claiborne	20,000	2,000
Total	614,500	44,000

MICHIGAN

Grimes, Otha, Mount Pleasant, Isabella	5,000	1,500
West Michigan Consumers, Reed City, Osceola	15,000	30,000
Total	20,000	31,500

MONTANA

Union Oil Corp. of Cal., Cut Bank, Glacier	25,000	.....

NEW MEXICO

El Paso Natural Gas Co., Jal 1, Lea	60,000	.....
El Paso Natural Gas Co., Jal 2, Lea	90,000	.....
Loco Hills Press. Maint. Co., Loco Hills, Eddy	10,000	.....
Maljamar Coop. Repress. Agreement, Artesia, Eddy	40,000	.....
Phillips Pet. Co., Eunice, Lea	100,000	.....
Phillips Pet. Co., Lee, Lea	37,000	.....
Phillips Pet. Co., Hobbs, Lea	50,000	.....
Skelly Oil Co., Eunice, Lea	30,000	.....
Warren Pet. Corp., 18 Monument, Lea	30,000	20,000
Total	447,000	20,000

OHIO

East Ohio Gas Co., Doylestown	5,000	.....
East Ohio Gas Co., Highland Heights	3,500	.....
Preston Oil Co., The, Elk, Noble County	3,000	.....
Preston Oil Co., The, Homer, Licking County	10,000	.....
Preston Oil Co., The, Pavonia, Richland County	10,000	.....

OHIO (Continued)

Company, plant and county—	Approx. capacity, gallons per day: Natural	L.P.G.
Preston Oil Co., The, Sugar Grove, Fairfield	10,000	.....
Preston Oil Co., The, Medina County	4,000	5,000
River Gas Co., Ludlow, Monroe	1,400	.....
Total	46,900	5,000

OKLAHOMA

Barksdale Co., Barksdale, Hughes	500	.....
Barnsdall Oil Co., Earlsboro, Pottawatomie	20,000	10,000
Barnsdall Oil Co., Avant, Osage	2,500	.....
Carter Oil Co., The, Grisso, Seminole	40,000	35,000
Carter Oil Co., The, Fitts, Pontotoc	40,000	15,000
Carter Oil Co., The, Cromwell, Seminole	25,000	10,000
Cimarron Gasoline Corp., Guthrie, Logan	10,000	.....
Cimarron Gasoline Corp., Coyle, Logan	15,000	.....
Cities Service Oil Co., James-Lacey, Seminole	15,000	.....
Cities Service Oil Co., Bodine, Oklahoma	60,000	.....
Cities Service Oil Co., Konawa, Seminole	15,000	.....
Cities Service Oil Co., Asher, Pottawatomie	10,000	.....
Cities Service Oil Co., Tallant, Osage	20,000	.....
Cities Service Oil Co., Fish-Sasakwa, Seminole	15,000	.....
Coldren, H. B., Barnsdall	1,000	.....
Continental Oil Co., Plant 31, Noble	20,000	.....
Crosbie, J. E., Inc., Fittstown, Pontotoc	14,000	7,000
Crosbie, J. E., Inc., Stroud, Lincoln	12,000	1,000
Deep Rock Oil Corp., Hawk, Payne	1,000	.....
Devonian Oil Co., Kellyville, Creek	15,000	10,000
Eason Oil Co., Crescent, Logan	18,000	8,000
Eason Oil Co., Garber	1,600	.....
Frame Natural Gas Co., Plant 1, Pawnee	3,000	.....
Frame Natural Gas Co., Plant 2, Pawnee	1,500	.....
Grimes, Chas. and Otha, Weleetka, Okfuskee	5,000	.....
Grimes, Chas. and Otha, Okemah, Okfuskee	3,000	.....
Grimes, Otha H., Wetumka, Hughes	5,000	1,500
Grimes, Otha H., Pauls Valley, Garvin	20,000	20,000
Grimes, Otha H., and Roy Neil, Drumright, Creek	4,000	.....
Gulf Oil Corp., Boston, Osage	1,500	.....
Gulf Oil Corp., Burbank, Osage	10,000	.....
Gulf Oil Corp., Kiefer, Creek	20,000	.....
Gulf Oil Corp., Mission, Seminole	12,500	.....
Keener Oil & Gas Co., The, Bartlett, Custer	15,000	15,000
Lessig, L. G., Plant 1, Creek	500	.....
Lone Star Gas Co., Hollis, Harmon	15,000	3,000
Magnolia Pet. Co., Davenport, Lincoln	3,600	.....
Magnolia Pet. Co., Graham, Carter	4,600	.....
Magnolia Pet. Co., Davenport, Creek	18,000	.....
Magnolia Pet. Co., Stonewall, Pontotoc	30,000	.....
Magnolia Pet. Co., St. Louis, Pottawatomie	16,000	.....
Mid-Continent Pet. Corp., Leonard 9, Tulsa	200	.....
Mid-Continent Pet. Corp., Sawyer 3, Creek	7,000	3,000
Mid-Continent Pet. Corp., Stillwater 18, Payne	5,000	9,000
Mid-Continent Pet. Corp., Stone Bluff 4, Wagoner	600	.....
Mid-Continent Pet. Corp., Cromwell 7, Seminole	15,000	10,000
Neal Gasoline Co., Osage, Pawnee	4,700	.....
Peppers Ref. Co., W. Edmond, Oklahoma	30,000	6,000
Peppers Ref. Co., Plant 1, Oklahoma	20,000	9,000
Phillips Pet. Co., Reserve, Osage	35,000	.....
Phillips Pet. Co., Dill, Okfuskee	25,000	.....
Phillips Pet. Co., Wetumka, Hughes	20,000	.....
Phillips Pet. Co., Oklahoma City, Oklahoma	150,000	.....
Phillips Pet. Co., 11-11, Okfuskee	10,000	.....
Phillips Pet. Co., Wewoka, Seminole	30,000	.....
Phillips Pet. Co., Edmond, Oklahoma	65,000	.....
Phillips Pet. Co., Denoya, Osage	75,000	.....
Pioneer Corp., Bixby	1,000	.....
Powers, M. F., Depew, Creek	2,500	500
Pure Oil Co., Plant 15, Seminole	20,000	.....
Pure Oil Co., Drumright 1, Creek	10,000	.....
Pure Oil Co., Berryhill Vacuum, Creek	5,000	.....
Pure Oil Co., Poloke Vacuum, Creek	7,000	.....
Shell Oil Co., Inc., Osage, Osage	10,000	.....
Shell Oil Co., Inc., Dillard, Carter*	16,000	.....
Shell Oil Co., Inc., Lucien, Noble*	36,000	8,000
Shell Oil Co., Inc., Barco, Carter	12,000	.....
Shell Oil Co., Inc., Tonkawa, Noble*	10,000	.....
Sinclair Prairie Oil Co., Seminole 12, Seminole	25,000	.....
Sinclair Prairie Oil Co., Lima 13, Seminole	50,000	50,000
Sinclair Prairie Oil Co., St. Louis 14, Pott.	65,000	.....
Sinclair Prairie Oil Co., Drumright 2, Creek	35,000	.....
Sinclair Prairie Oil Co., Shamrock 3, Creek	25,000	.....
Sinclair Prairie Oil Co., Covington 6, Garfield	15,000	10,000
Skelly Oil Co., Fairfax, Osage	70,000	.....
Skelly Oil Co., Naphtha, Osage	50,000	.....
Skelly Oil Co., Lyman, Osage	50,000	.....
Swab, J. F., Wewoka, Seminole	3,500	.....
Texas Co., The, Blackbird, Osage	4,000	.....
Texas Co., The, Davenport, Lincoln	12,000	.....
Texas Co., The, Moore, Creek	13,000	.....
Tide Water Asso. Oil Co., Drumright, Creek	15,000	.....
Victor Gasoline Co., Bristow 3, Creek	4,000	.....
Victor Gasoline Co., Stroud 12, Lincoln	2,500	.....

... MARLOW Diffuser-Priming Centrifugal Pump

A Marlow handles volatile liquids as easily as most pumps handle water. It will not vapor-lock. It is positively self-purging on high suction lifts and operates without manipulation or adjustment. It can handle even aromatic high-octane aviation gasoline without vapor-locking.

It is equally dependable for long, continuous periods of operation or for intermittent stop and start service. As in a regular centrifugal, the impeller alone moves the liquid. Automatic action is accomplished by means of the exclusive, stationary diffuser which is built into the pump. There are no ports, by-passes or other auxiliary devices which reduce efficiency and cause maintenance problems.

A Marlow makes it possible to improve many handling operations. Models are made with electric, gasoline or Diesel power, 1½ to 10-inch sizes, with capacities of 70 to 5700 barrels per hour. Detailed information will be mailed promptly. Write today.

MARLOW PUMPS ★ RIDGEWOOD, NEW JERSEY

OKLAHOMA (Continued)

Company, plant and county—	Approx. capacity, gallons per day: Natural	L.P.G.
Warren Pet. Corp., Graham 8, Carter	15,000	5,000
Warren Pet. Corp., Madill 22, Marshall	30,000	20,000
Warren Pet. Corp., Maud 15, Seminole	20,000	20,000
Wright, Rosa B., Kellyville, Creek	5,000	.....
Total	1,689,800	286,000

*Partnership.

PENNSYLVANIA

Alum Rock Gas Co., Port Allegany, Fern	50	.....
Bayliss & Bayliss, Titusville	10,000	.....
Clinger Oil & Gas Co., Tidioute, Fagundus	1,000	.....
Clinger Oil & Gas Co., Tidioute, Hastings	1,000	.....
Crawford & Gregory, Emlenton, Fryburg	500	.....
Ellenburger, W. J., & Sons, Karns City	300	.....
Elliott Brothers, Chicora	500	.....
Equitable Gas Co., Marianna, Washington	2,000	.....
Equitable Gas Co., Rogersville, Green	10,000	.....
Harvey, John J., estate, Titusville, Pleasantville	500	.....
Haskell, Roth & Bayless, Tidioute, Warren	10,000	.....
Hickey & Russell, Henry's Mill	300	.....
Jennings, E. H., Bros. Co., McDonald (2 plants)	1,700	.....
Manufacturers Light & Heat Co., W. Finley	5,000	.....
Manufacturers Light & Heat Co., Majorsville	10,000	.....
Mars Co., Pinegrove, Venango	4,000	.....
Mars Co., Van, Venango	7,500	2,000
Mars Co., New Freeport, Greene	175	.....
Mars Co., Noblestown, Washington	575	.....
Pennsylvania Oil Co., Sheffield, Warren	10,000	.....
Peoples Natural Gas Co., The, Brave, Greene	20,000	.....
Sloan & Zook Co., Kane, McDonald Wash	900	600
South Penn Oil Co. (5 plants)	1,900	.....
Surety Oil Co., Titusville	1,000	.....
Surety Oil Co., Tiona, Warren	500	.....
Surety Oil Co., Trueman's Forrest	140	.....
Wible, W. Paull, Karns City	100	.....
Miscellaneous*	2,820	.....
Total	102,460	600

*Covers 21 plants each with daily capacity of 200 gal. and less.

TEXAS

Railroad Commission District 2

Clymore Co., Inc., Clymore, Refugio	20,000	.....
Humble Oil & Refining Co., Heyser, Calhoun	10,000	.....
United Gas Pipe Line Co., Refugio	75,000	.....

Railroad Commission District 3

Abercrombie, J. S., and Magnolia Pet. Co., Old Ocean, Brazoria	240,000	.....
American Republics Corp., Joe's Lake, Tyler	24,000	.....
Danciger Oil & Ref. Co., Pledger, Matagorda	32,000	4,000
Del Rey Pet. Co., Hardin, Liberty	15,000	.....
B. & W. Gasoline Co., Cleveland, Liberty	7,000	.....
Hamman Oil & Ref. Co., Hamman, Matagorda	13,000	.....
Humble Oil & Ref. Co., Conroe, Montgomery	18,000	.....
Humble Oil & Ref. Co., Tomball, Harris	34,000	.....
Humble Oil & Ref. Co., Dickinson, Galveston	11,000	.....
Midland Gasoline Co., Conroe, Montgomery	30,000	.....
Warren Pet. Corp., Plant 20, Fairbanks, Harris	25,000	15,000

Railroad Commission District 4

Duval Gasoline Co., Benavides, Duval	10,000	4,000
Humble Oil & Ref. Co., Flour Bluff, Nueces	14,000	.....
Sinclair Prairie Co., East White Point, San Patricio	12,000	9,000
Smith Brothers Ref. Co., Inc., Welder, San Patricio	15,000	.....
Southern Minerals Corp., Saxet, Nueces	20,000	.....
Southern Minerals Corp., Stratton	12,000	.....
Stanolind Oil & Gas Co., Luby, Nueces	30,000	15,000
United Gas Pipe Line Co., Agua Dulce, Nueces	45,000	.....

Railroad Commission Districts 5 and 6

Arkansas Fuel Oil Co., Waskom, Harrison	12,000	2,000
Arkansas Fuel Oil Co., East Texas, Gregg	40,000	40,000
Arkansas Fuel Oil Co., Carthage, Panola	6,650	1,000
Arkansas Fuel Oil Co., Smithland, Marion	5,000	.....
Arkansas Fuel Oil Co., Jefferson, Jefferson	10,000	2,500
Gregg-Tex Gasoline Corp., Gregg-Tex, Gregg	100,000	.....
Gulf Oil Corp., Cashen, Rusk	13,500	13,000
Gulf Oil Corp., Kilgore, Gregg	55,000	60,000
Hanlon Gasoline Corp., Gladewater, Gregg	100,000	.....
Hargraves, F. E., Boggey Creek, Anderson	3,000	.....
Humble Oil & Ref. Co., American, Gregg	44,000	.....
Humble Oil & Ref. Co., Kilgore, Gregg	44,000	.....
Humble Oil & Ref. Co., London, Rusk	40,000	68,000
Lisbon Gasoline Co., East Texas, Rusk	50,000	50,000
Lone Star Gas Co., Trinidad, Henderson	30,000	11,000
Mid-Co Gasoline Co., Cayuga, Henderson	7,000	4,000
Natural Gasoline Corp., Plant 25, Hawkins, Wood	50,000	4,000

TEXAS (Continued)

Company, plant and county—	Approx. capacity, gallons per day: Natural	L.P.G.
Nine Oaks, Gladewater, Gregg	900	.....
Parade Gasoline Co., Giles, Rusk	70,000	60,000
Pewitt, P. H., Joaquin, Shelby	2,000	.....
Phillips Pet. Co., Lodi, Cass	40,000	.....
Pure Oil Co., Van, Van Zandt	40,000	.....
Sabine Valley Gasoline Co., Kilgore, Gregg	60,000	60,000
Sinclair Prairie Oil Co., Plant 18, Gregg	70,000	12,000
Sinclair Prairie Oil Co., Plant 19, Rusk	70,000	90,000
United Gas Pipe Line Co., Carthage	78,000	10,000

Railroad Commission District 7

Anzac Oil Corp., Overall, Coleman	300	.....
Big Lake Oil Co., Texon, Reagan	10,000	.....
Consolidated Gasoline Co., Martin, Eastland	4,000	.....
Desdemona Gasoline Co., Desdemona, Comanche	3,000	.....
Hanlon Gasoline Co., Breckenridge, Stephens	40,000	.....
Lone Star Producing Co., Ranger, Eastland	20,000	15,000
Lone Star Producing Co., Brooks, Stephens	20,000	15,000
Lone Star Gas Co., Gordon, Palo Pinto	15,000	10,000
Lone Star Gas Co., Cisco, Eastland	5,000	.....
Magnolia Pet. Co., Desdemona, Eastland	4,500	.....
Magnolia Pet. Co., Olden, Eastland	5,000	.....
Phillips Pet. Co., Eliasville, Stephens	12,000	.....
Phillips Pet. Co., Frankell, Stephens	8,500	.....
Phillips Pet. Co., Ibex, Shackelford	12,000	.....
Phillips Pet. Co., Pioneer, Eastland	15,000	.....
Roeser & Pendleton, Cook, Shackelford	6,000	.....
Roeser & Pendleton, Bluff Creek, Shackelford	2,000	.....
Rudco Oil & Gas Co., Desdemona, Eastland	5,000	.....
Rudco Oil & Gas Co., Rising Star, Brown	5,000	.....
Texas Pacific Coal & Oil Co., Stephens	10,000	9,000

Railroad Commission District 8

Barnsdall Oil Co., Odessa, Ector	16,000	4,000
Cabot Carbon Co., Estes, Ward	30,000	15,000
Cabot Carbon Co., Keystone, Winkler	30,000	.....
Cabot Carbon Co., Kermit, Winkler	45,000	.....
Cities Service Oil Co., Odessa, Ector	20,000	.....
Gulf Oil Corp., Monahans, Ward	19,000	.....
Magnolia Pet. Co., Kermit, Winkler	18,000	.....
Phillips Pet. Co., Fullerton, Andrews	52,000	.....
Phillips Pet. Co., Goldsmith, Ector	60,000	.....
Phillips Pet. Co., Crane, Crane	40,000	.....
Phillips Pet. Co., Judkins, Ector	40,000	.....
Phillips Pet. Co., Seminole, Gaines	60,000	.....
Shell Oil Co., Inc., Wasson 1, Yoakum	60,000	.....
Shell Oil Co., Inc., Wasson 2, Yoakum	60,000	.....
Standard Oil Co. of Texas, Ward, Ward	20,000	.....

Railroad Commission District 9

Continental Oil Co., K.M.A. 33, Wichita	60,000	.....
Deep Oil Development Co., Wilson 1, Archer	400	.....
Deep Oil Development Co., K.M.A. 2, Wichita	3,500	.....
Highlander Gasoline Co., Nocona, Montague	4,000	.....
Magnolia Pet. Co., Burkburnett, Wichita	4,000	.....
Magnolia Pet. Co., Electra, Wilbarger	6,000	.....
Nash Gasoline Co., South Bend	10,000	5,000
Nash Gasoline Co., James, Young	4,000	4,000
Phillips Pet. Co., Mankins, Wichita	65,000	.....
Phillips Pet. Co., South Bend, Young	9,000	.....
Skelly Oil Co., Burkburnett, Wichita	10,000	.....
Skelly Oil Co., Ramming, Wichita	1,500	.....
Texas Co., The, Burkburnett, Wichita	13,000	.....
Texas Co., The, Electra, Wilbarger	19,000	.....
Texas Co., The, Johnson, Foard	6,000	.....
Tucker Oil Co., Burkburnett, Wichita	2,100	.....
Waggoner, W. T., estate, Rock Crossing, Wilbarger	7,000	.....

Railroad Commission District 10

Canadian River Gas Co., Bivins, Moore	35,000	.....
Cannon Gasoline Co., Amarillo, Potter	10,000	1,000
Cities Service Oil Co., Pampa, Gray	25,000	.....
Coltexo Corp., Lefors, Gray	30,000	.....
Columbian Gasoline Corp., Shamrock, Wheeler	12,000	.....
Danciger Oil & Ref. Co., Lefors, Gray	20,000	1,500
Hagy, Harrington & Marsh, Cargray, Carson and Gray	35,000	35,000
Henderson Trust No. 2, Sanford, Hutchinson	40,000	.....
Huber, J. M., Corp., Borger, Hutchinson	25,000	.....
Magnolia Pet. Co., Kingsmill, Gray	9,000	.....
Magnolia Pet. Co., Sunray, Moore	22,000	.....
Phillips Pet. Co., Bowers, Gray	50,000	.....
Phillips Pet. Co., Canadian, Hutchinson	60,000	.....
Phillips Pet. Co., Carson, Carson	20,000	.....
Phillips Pet. Co., Gray, Gray	100,000	.....
Phillips Pet. Co., Hansford, Hansford	40,000	.....
Phillips Pet. Co., Johnson, Hutchinson	50,000	.....
Phillips Pet. Co., Lefors, Gray	15,000	.....
Phillips Pet. Co., North, Gray	50,000	.....
Phillips Pet. Co., Pampa, Gray	60,000	.....
Phillips Pet. Co., Panhandle, Carson	15,000	.....

TEXAS (Continued)

Company, plant and county—	Approx. capacity, gallons per day: Natural	L.P.G.
Phillips Pet. Co., Pantex, Hutchinson	50,000	.....
Phillips Pet. Co., Rock Creek, Hutchinson	90,000	.....
Phillips Pet. Co., Sanford, Hutchinson	50,000	.....
Phillips Pet. Co., Texroy, Hutchinson	15,000	.....
Phillips Pet. Co., Sneed, Moore	100,000	.....
Portland Gasoline Co., Pampa, Gray	24,000	8,000
Shamrock Oil & Gas Corp., The, McKee, Moore	110,000	80,000
Shell Oil Co., Inc., Bryan 2 and 17, Carson	30,000	.....
Shell Oil Co., Inc., Pampa, Gray	15,000	.....
Skelly Oil Co., Armstrong, Moore and Hutchinson	15,000	.....
Skelly Oil Co., Schafer, Carson	30,000	.....
Skelly Oil Co., Crawford, Hutchinson	15,000	.....
Skelly Oil Co., Kingsmill, Gray	30,000	.....
Skelly Oil Co., Watkins, Hutchinson	15,000	.....
Smith Bros. Ref. Co., Inc., Sitter, Wheeler	40,000	.....
Texoma Natural Gas Co., Fritch, Hutchinson	85,000	.....
Texoma Natural Gas Co., Stinnett, Moore	22,000	.....
West Texas Gas Co., Wilhelm, Potter	20,000	.....
Total	4,228,850	737,000

WEST VIRGINIA

Carnegie Natural Gas Co., Hundred, Wetzel	1,000	.....
Dinsmoore & Co., St. Marys, Sugar Creek, Shawnee, Henry Camp, Bills 10-Acre, Fetty, Roby, Brush Run and Pike plants	200	.....
Falling Rock Cannel Coal Co., Falling Rock	3,000	.....
Hapgood, Roswell T., & Co., Cedar Grove, Kanawha	6,500	.....
Henaghan & Hanlon, Inc., Sistersville, Big Knot	1,000	.....
Burns	800	.....
Hammee	2,000	.....
Harrisville	500	.....
Highland	800	.....
Murphy	300	.....
Nye	1,500	.....
Rock Run	600	.....
Hope Natural Gas Co., Bristol, Harrison	8,000	.....
Cornwell, Kanawha	14,000	.....
Goff, Harrison	5,000	.....
Hastings, Wetzel	60,000	.....
Kennedy, Lewis	20,000	.....
Waverly, Wood	8,000	.....
Jennings, E. H., Bros. Co., Jacksonburg, Wetzel (2 plants)	1,800	.....
Owens, Libby-Owens Gas Dept., South Malden	10,000	5,000
Pure Oil Co., Dawes	12,000	.....
South Penn Natural Gas Co.:		
Blackshere, Monongalia	700	.....
Clay, Roane	1,200	.....
Edgell, Roane	1,200	.....
Fairview, Marion	1,660	.....
Falling Rock, Roane	600	.....
Griffith, Kanawha	1,000	.....
Hartley, Ritchie	1,000	.....
Lynch, Harrison	1,440	.....
Metz, Monongalia	560	.....
Morgan, Wetzel	2,000	.....
Pine Grove, Wetzel	1,260	.....
Rock Creek, Roane	750	.....
Stringtown, Tyler	1,000	.....
Tanner, Gilmer	900	.....
Victor, Kanawha	2,500	.....
Miscellaneous (15 plants)	3,000	.....
Union Gaso. & Oil Corp., Moundsville, Marshall	3,000	.....
Jane Lew, Lewis	3,000	.....
Porter Falls, Wetzel	10,000	.....
Virginian Gaso. & Oil Co., Charleston, Kanawha	15,000	.....
Clendenin, Kanawha	40,000	.....
Hubball, Lincoln	12,000	.....
Jarretts Fords, Kanawha	1,800	.....
Mammoth, Kanawha	2,500	.....
Ona, Cabell	18,000	.....
St. Albans, Kanawha	3,500	.....
Sandyville, Jackson	20,000	.....
Three Mile, Kanawha	3,500	.....
Miscellaneous	4,350	.....
Total	314,420	5,000

WYOMING

Continental Oil Co., Lance Creek, Niobrara	120,000	.....
Northern Utilities Co., Sand Draw, Fremont	4,500	.....
Ohio Oil Co., The, Grass Creek, Hot Springs	3,600	.....
Ohio Oil Co., The, Rock River, Carbon	5,000	.....
Sinclair-Wyo. Oil Co., Lost Soldier, Baroil	5,000	.....
Standard Oil & Gas Co., Salt Creek, Natrona	51,000	42,000
Total	189,100	42,000

Survey of Cycling Plants

SUMMARY OF ACTIVE CYCLING PLANTS—1946

	Approx. production, gal. per day: Natural	L.P.G.
California	79,800	17,100
Louisiana	1,124,000	134,000
Pennsylvania	500	.....
Texas	2,032,500	313,600
Total United States	3,236,800	464,700

CALIFORNIA

Company, plant and county—	Approx. capacity, gallons per day: Natural	L.P.G.
Ohio Oil Co.,* South Soles Levee, Kern	29,800	17,100
Western Gulf Oil Co., Paloma, Kern	*50,000	.....
Total	79,800	17,100

*Unit operation.

LOUISIANA

Cotton Valley Oper. Comm., Webster	500,000	.....
Stanolind Oil & Gas Co., Jefferson Davis	50,000	8,000
Texas Co., The, Erath, Vermilion	504,000	126,000
Texas Co., The, Bateman Lake, St. Mary	70,000	.....
Total	1,124,000	134,000

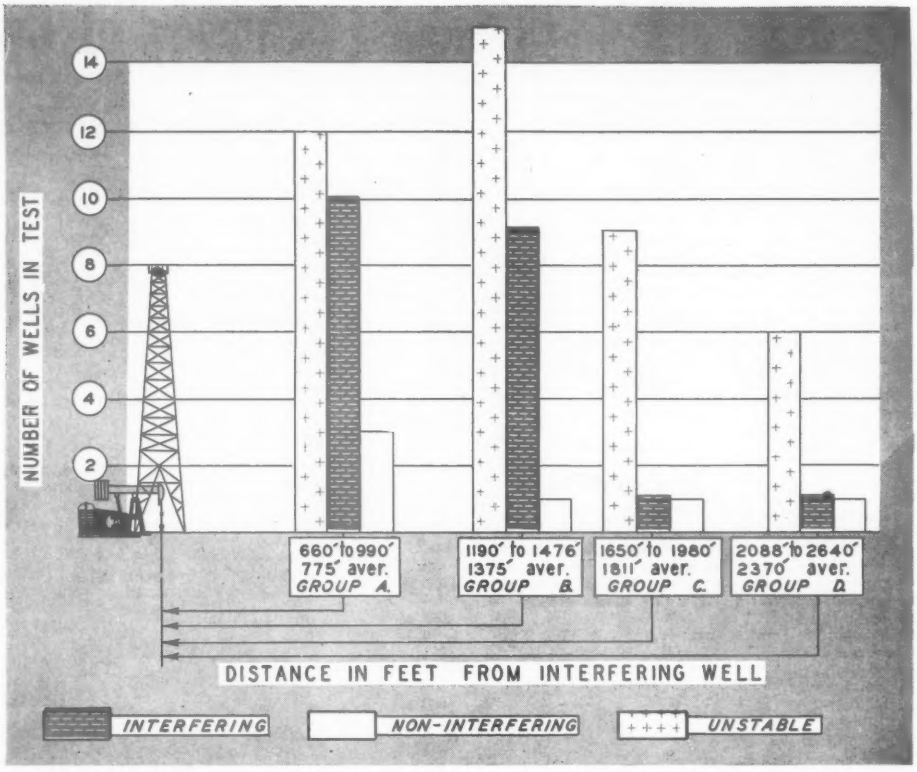
PENNSYLVANIA

Harvey, Mrs. Alice G., Titusville, Forrest	500	.....

TEXAS

Agua Dulce Co., The, Banquete, Nueces	40,000	2,000
American Liberty Oil Co., Blessing, Matagorda	40,000	.....
American Liberty Oil Co., Grapeland, Houston	50,000	.....
Anco Gas Corp., Long Lake, Anderson	50,000	.....
Chicago Corp., The (Gulf Plain), Stratton, Nueces	2,000	800
Chicago Corp., The (Coastal), Agua Dulce, Nueces	1,800	800
Chicago Corp., The (Wardner), Stratton, Nueces	2,500	800
Distillate Prod. Corp., North Houston, Harris	83,000	.....
Duval Gasoline, Benavides, Duval	5,000	3,000
Duval Gasoline Co., Southland, Duval	8,000	.....
Francitas Gas Co., Francitas, Jackson	70,000	.....
Gasoline Production Corp., Grapeland, Houston	65,000	.....
Geier-Jackson Recycling Co., Grapeland, Houston	75,000	.....
Gulf States Recycling Co., San Salvador, Hidalgo	300	.....
Harrell, H. M., Bammel, Harris	40,000	.....
Humble Oil & Ref. Co., Katy, Waller	480,000	150,000
Hunt Oil Co., Long Lake, Anderson	50,000	.....
Killam, O. W., Joyce Richardson, Harris	*15,000	.....
La Gloria Corp., La Gloria, Jim Wells	4,900	2,200
Lockhart, L. M., Banquete, Nueces	40,000	.....
Lone Star Prod. Co.-Trinity Gas Corp., Grapeland, Houston	100,000	20,000
Lone Star Prod. Co., Opelika, Henderson	160,000	25,000
Lone Star Prod. Co., Willow Springs, Gregg	25,000	4,000
Roeser & Pendleton, Cayuga, Henderson	5,000	.....
Shell Oil Co., Inc., Sheridan, Colorado	283,000	.....
Skinner & Eddy Corp., Alice, Jim Wells	35,000	.....
Stanolind Oil & Gas Co., La Rosa, Refugio	44,000	6,000
Superior Oil Co., The, Lake Creek, Montgomery	*104,000	90,000
Sun Oil Co., Seabreeze, Chambers	*14,000	5,000
Sun Oil Co., Willow Slough, Chambers	.....	.....
Tide Water Asso.-Seaboard, Cauyga 1-A, Anderson	8,000	.....
Tide Water Asso.-Seaboard, Cayuga 2-A, Anderson	22,000	.....
Tide Water Asso.-Seaboard, Long Lake, Anderson	40,000	4,000
Trinity Gas-Standard of Texas, Sejita, Duval	70,000	.....
Total	2,032,500	313,600

*Unit operation.



Summary of tests in western Kansas Arbuckle limestone pools A, B, C, D, and E—with respect to distances from the source of interference (producing well)

PART 2 OF A SERIES

by
Kenneth B. Barnes

WELL-INTERFERENCE EFFECTS

Tested on 83 Wells in Six Different Areas in Kansas At Distances That Varied From 660 to 2,640 Feet

WELL-INTERFERENCE tests recently were reviewed in connection with the matter of well spacings in western Kansas, and the assignment of acreages to wells for setting allowables. For one part of the factual evidence collected and studied, the Kansas Oil Conservation Division made a series of interference tests between groups of wells in five different producing areas.

Also presented at the hearings were interference data of the "reverse-pattern type" taken by a major company in another producing area. Summaries of these tests, which altogether involve 83 wells in six producing areas, are given in diagram form in this article.

Procedure Used in Interference Tests

L. B. Taylor, engineer for the Oil Conservation Division, arranged and supervised the interference tests for that office, and prepared and presented the results in tabular form to the commission. One series of tests was made in the Boyd pool, two in the Richardson pool, and two in the South Silica pool. All of these pools produce from the Arbuckle dolomite, at depths between 3,250 and 3,550 ft. The general procedure used was to shut in the pool, usually for 7 days, and during the shut-in period observe the rise in fluid levels of all wells in the selected area. Depths to the fluid level of each of the wells were obtained by sonic measurements at 72, 96, 120, and 168 hours after the field was shut in.

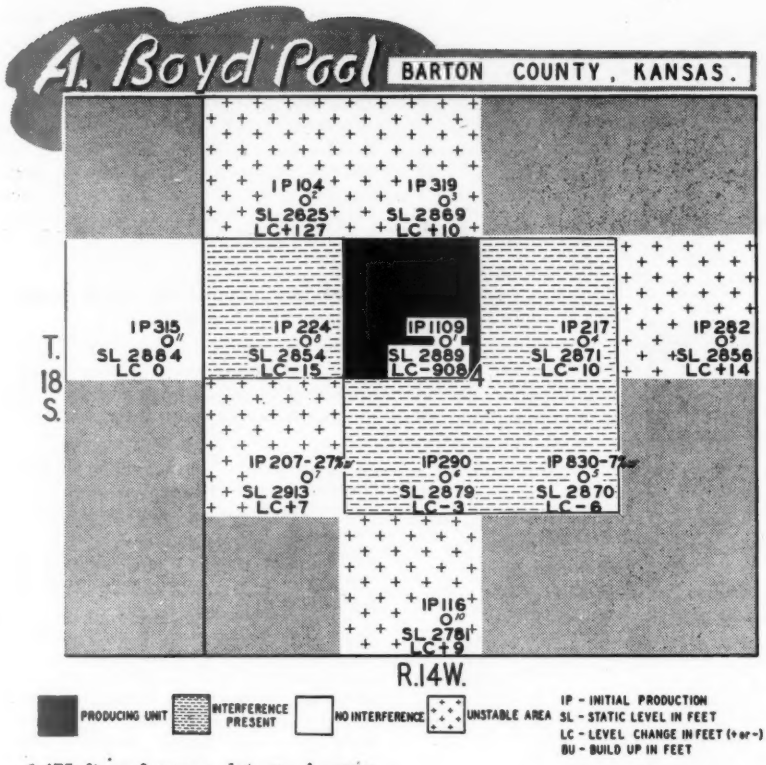
The number of tubing collar reflections to the fluid-level point, in a measurement, were converted to the number of feet from the casing head to the fluid level. Correction for ground elevation was then made, to express the fluid levels as feet **above** a uniform subsea elevation across the producing area. At Boyd this subsea elevation was —1,475 ft., at Richardson —1,725, at South Silica —1,500.

A centrally located well in the selected area then was pumped at a constant rate, usually for 5 days. While the pumping of the central well continued, fluid-level measurements of the wells were made at 24, 48, 72, 96, and 120 hours after pumping started. Fluid level in the producing well also was obtained at the same time. In the following discussion of the tests, the actual data obtained have been summarized in the accompanying illustrations and comment will be limited to the more unusual results found.

Boyd Pool—Test "A"

In the Boyd pool where the first series of tests was made, the fluid-level measurements were somewhat more numerous, the readings being at 61, 70, and 88 hours after initial complete shut-in, then at 3, 20, 27, 44, 51, 68, and 97 hours during the pumping phase.

In the productive area selected in the pool, the tests involved the central produced well and 10 adjacent shut-in wells, the latter varying from 1,320 to 2,640 ft. in distance from the pumping well (Map A). At 88 hours after the pool had been shut in, and just before pumping the central well commenced, the fluid levels in the shut-in wells had reached points varying from 2,625 to 2,913 ft. above the



as being due to an unstabilized initial condition, without further comment. The data pertaining to the shut-in wells where this situation occurred have not been analyzed to the extent of determining whether interference was present. It is possible, of course, that interference could be present in such wells, as shown by a lowering in their rate of buildup, and which was still going on at the time the production period started. Such an interference effect, however, would be of secondary order in comparison with the interferences where an actual drop in fluid levels took place. In summary, therefore, all wells which

***Left:** Pool shut in for 88 hours; fluid level of all wells tested. Central well pumped for 4 days at 334 bbl. oil per day; redetermined all fluid levels*

***SCORE:** Interference with four wells. Five wells were unstable, hence results indeterminate. One well, 2,640 ft. west, was not affected*

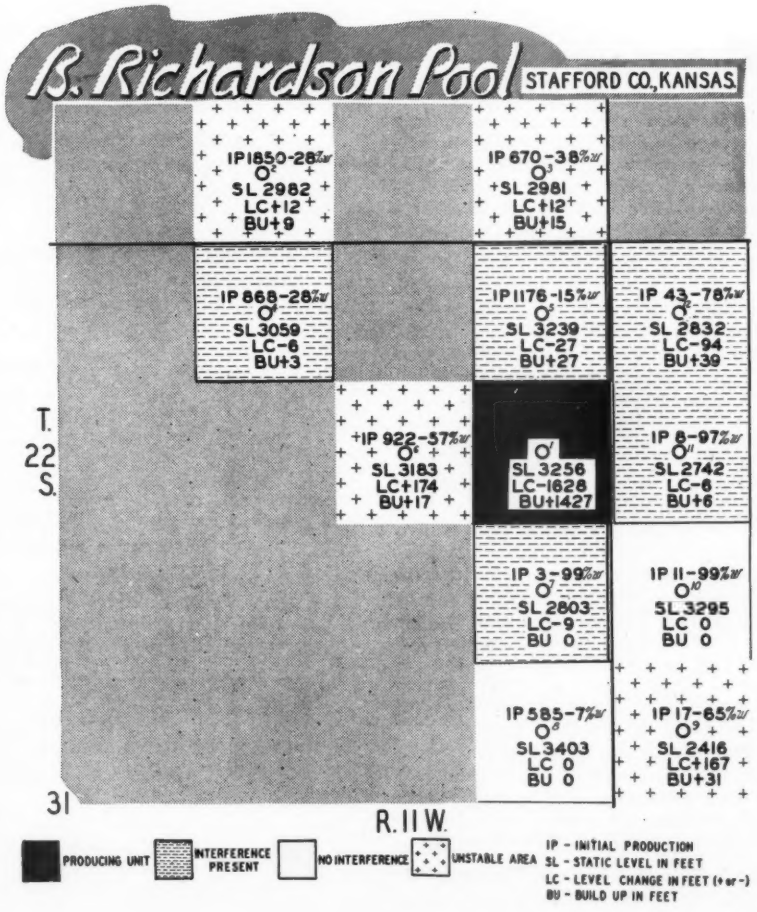
***Below:** Pool shut in for 7 days, fluid levels tested, then central well pumped for 5 days at rate of 57 oil-321 water per day; rechecked fluid levels of all the wells*

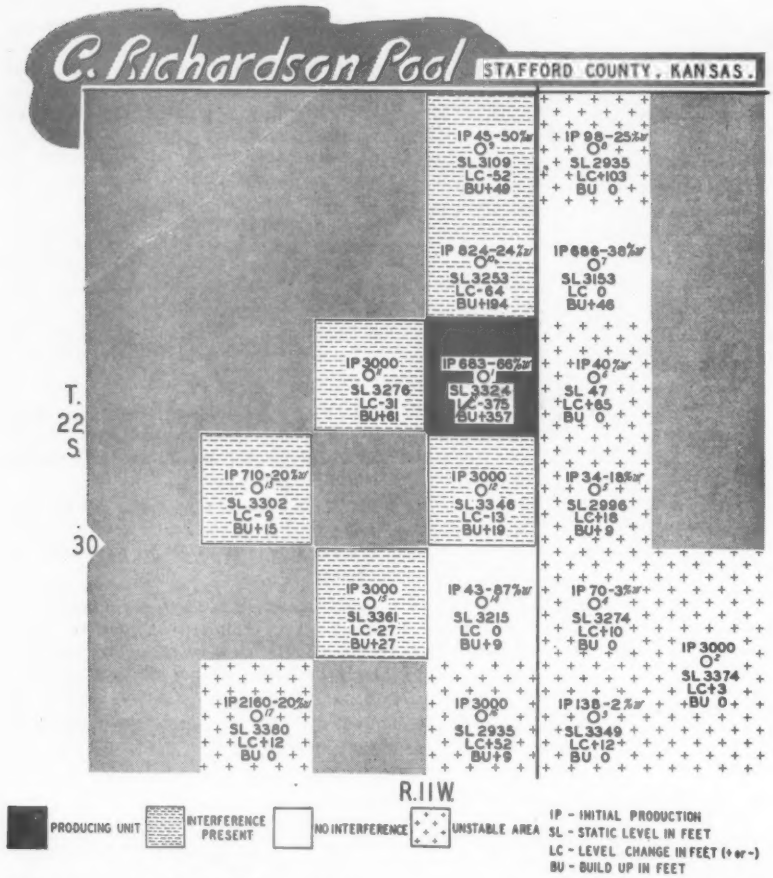
***SCORE:** Interference with five wells; two wells were not affected. Unstable conditions were present for four wells*

—1,475-ft. reference datum. As previously mentioned, after the wells had been shut in, but before pumping of the central well commenced, the rise in fluid levels toward equilibrium had been observed at successive times. This chain of data, of course, indicates whether equilibrium had been established before the pumping of the central well commenced. For example, in well No. 4 the fluid level was 2,871 ft. at 61 hours after shut-in, 2,871 ft. at 70 hours, and 2,871 ft. at 88 hours. It was not unexpected, however, that a considerable number of the wells did not reach equilibrium fluid level after the shut-in and before the production period started. This was the case, for example, of well 2, where the levels were 2,564, 2,581, and 2,625 ft. at 61, 70, and 88 hours after shut-in.

Seven fluid-level measurements of each of the shut-in wells were made while the central well was pumping. The last one (at 97 hours after pumping started) can be subtracted from the last fluid-level measurement made before pumping, to show the net feet of drawdown. Where the fluid levels dropped during the production period, these changes in levels or net drawdowns are shown as negative figures, but where the fluid levels rose during the pumping, the results on the maps are shown as positive numbers.

When the fluid level in a shut-in well rose between the beginning and the end of the production period, and therefore denoted as a positive number, the situation herein is classified





areas in this pool, (on Map E), one of the most interesting points is the large drawdown of 309 ft. which occurred in well 10, the south 40-acre offset from the producing well. The producing well itself, which had an initial productive capacity of 735 bbl. of oil per 24 hours, also had a very large drop of fluid level during the productive period, 2,632 ft. At 48 hours after pumping was stopped 2,051 ft. of the decline had been regained.

Recapitulation of Results in Terms of Distance

The results of tests A, B, C, D, E, and as summarized on the corresponding maps as to behavior of the closed-in wells, have been placed in

Left: Pool shut in 7 days, fluid levels tested. Pumped central well for 5 days at rate of 141 oil-203 water per day, then retested fluid levels

SCORE: Interference with six wells: two wells were not affected: eight wells had not stabilized

Below: Pool shut in 7 days and fluid levels determined. Pumped central well for 5 days at rate of 261 oil-141 water per day, then all levels retested. In 15 wells stable conditions were not reached, as the fluid levels were higher than before; furthermore, during a subsequent 48-hour shut-in test, their levels continued to rise. Level was not changed in two wells during pumping, although 48 hours later it rose 18 ft. in one and 19 ft. in the other. Level dropped in two wells during pumping test

had a net rise in fluid level during the production period have been classified as being in "unstabilized initial condition" regardless of whether interference occurred, as reflected in a decrease in the rate of buildup.

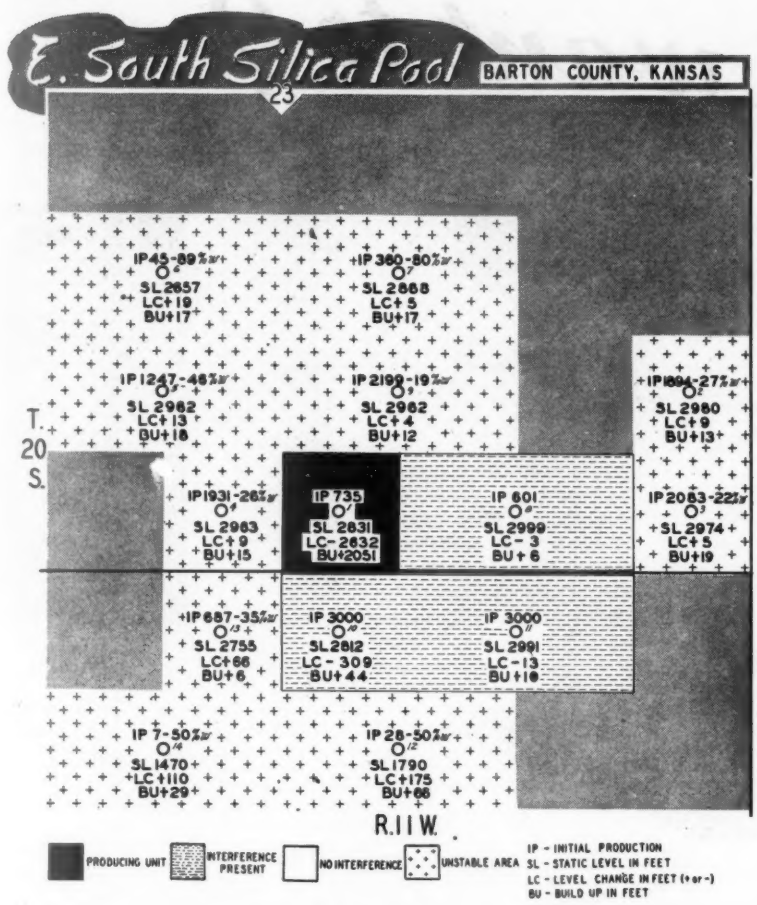
Richardson Pool—Tests "B" and "C"

In these tests and the others to be described, an additional measurement was added to that followed in the Boyd pool. At 48 hours after the end of the production period, the fluid levels in all the wells were again obtained. This information on the maps is given as the feet of rise of the fluid levels after 48 hours from the time the production period stopped. In some cases, such as for well 5, on Map B, the entire 27 ft. of drawdown which occurred during the 5-day production period was regained within 48 hours after the pumping well was shut down. The rebuilding of the 94-ft. drop in fluid level, however, for well 12, was only 39 ft. during the 48-hour interval, and for well 7 there was no rebuilding or increase in level whatever from the 9-ft. drop.

Still a different situation took place for well 10 (area C), which had had 64 ft. of drawdown during the production period, but rose 194 ft. in the subsequent 48-hour shut-in interval.

South Silica Pool—Tests "D" and "E"

Of the tests in the two selected



After pool was shut in 7 days, fluid levels were found, then central well was pumped at 316 oil-35 water/24 hours rate for 5 days. At end of that time all fluid levels were redetermined. Declines were found in three wells. The other 10 had increased (not originally stabilized). Subsequent 48-hour levels also were tested

three classifications: (1) Interference effect present, (2) no interference, as shown by no change in fluid level during production period, and (3) unstable initial condition. A simple statistical alignment of these classifications has been charted with respect to the distances between the closed-in wells and the central producing well (see cut). All told, there were 16 different distances involved, so for simplification these were placed within four groups, the ranges being 660 to 990 ft., 1,190 to 1,476 ft., 1,650 to 1,980 ft., and 2,088 to 2,640 ft. The weighted average distance for the wells in each of the groups from the point of interference also was computed.

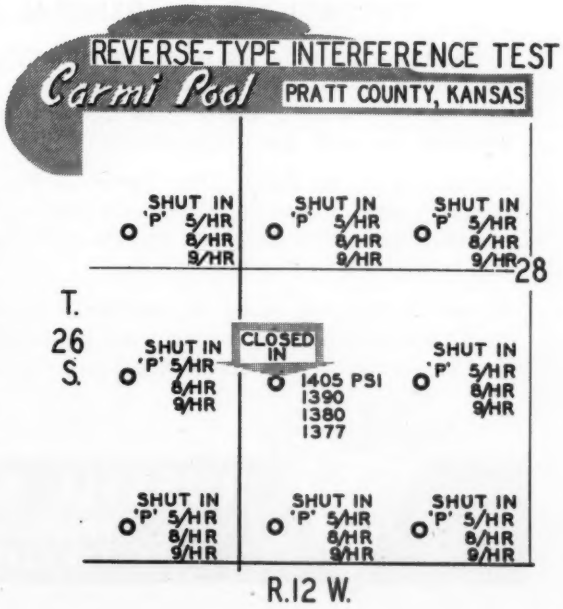
The results for the 775-ft. (weighted average) distance were that 40 per cent of the wells showed interference effect, 12 per cent showed no change, and 48 per cent were initially unstable. At 1,375-ft. distance, 35 per cent of the wells were interfered with, and 58 per cent were unstable. The increase with distance of the percentage of wells that were "initially unstable" might well be expected in such tests. At 1,811-ft. distance this classification rose to 82 per cent, and at 2,370 ft. to 86 per cent.

The large percentages of initially unstable wells in all the groups, unfortunately, result in considerable uncertainty in fixing any precise picture for the areas covered, and particularly for the longer distances. The number of unstable wells point up the necessity for test studies to be made or interpreted so that the observed wells can all be classified either as "affected" or "unaffected."

Reverse Type of Test Used in Carmi Pool

The "reverse type" of well-interference test was made in the Carmi pool (Arbuckle dolomite, 4,275 ft.) by one major company and the data presented at the Kansas hearing. Here (see map) a bottom-hole-pressure gage was run in the central well and the surrounding eight 40-acre offsets were simultaneously produced, first at 5 bbl. per hour, then 8 bbl. per hour, then at 9 bbl. per hour. As previously mentioned, this type of test, in a sense, throws a greater concentration of drawdown effect upon the shut-in well, but on the other hand, only the over-all effect can be ascertained.

Jack B. Roberts, Cisco, Tex., has been elected president of West Central Texas Oil and Gas Association, succeeding **Joseph Weaver,** Eastland. Other newly elected officers are **J. F. West,** Stamford, and **John P. Byram,** Abilene, vice president, and **Lloyd W. Holder,** Breckenridge, secretary-treasurer.



All wells shut in 51 hours. Central well then had 1,405 psi. bottom-hole pressure at 4,219 ft. Offsetting wells were pumped for 2 days at average rate of 5 bbl. per hour, and center well dropped to 1,390 psi. Subsequent 1-day pumping of offsets at 5 bbl. per hour declined pressure to 1,380 psi., at 9 bbl. per hour to 1,377 psi.

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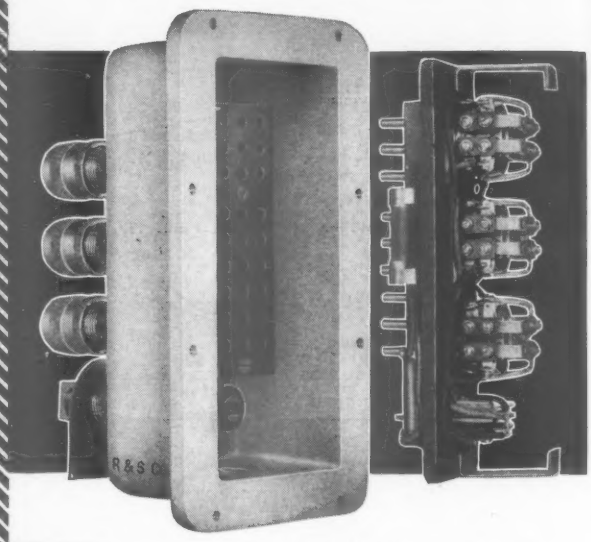

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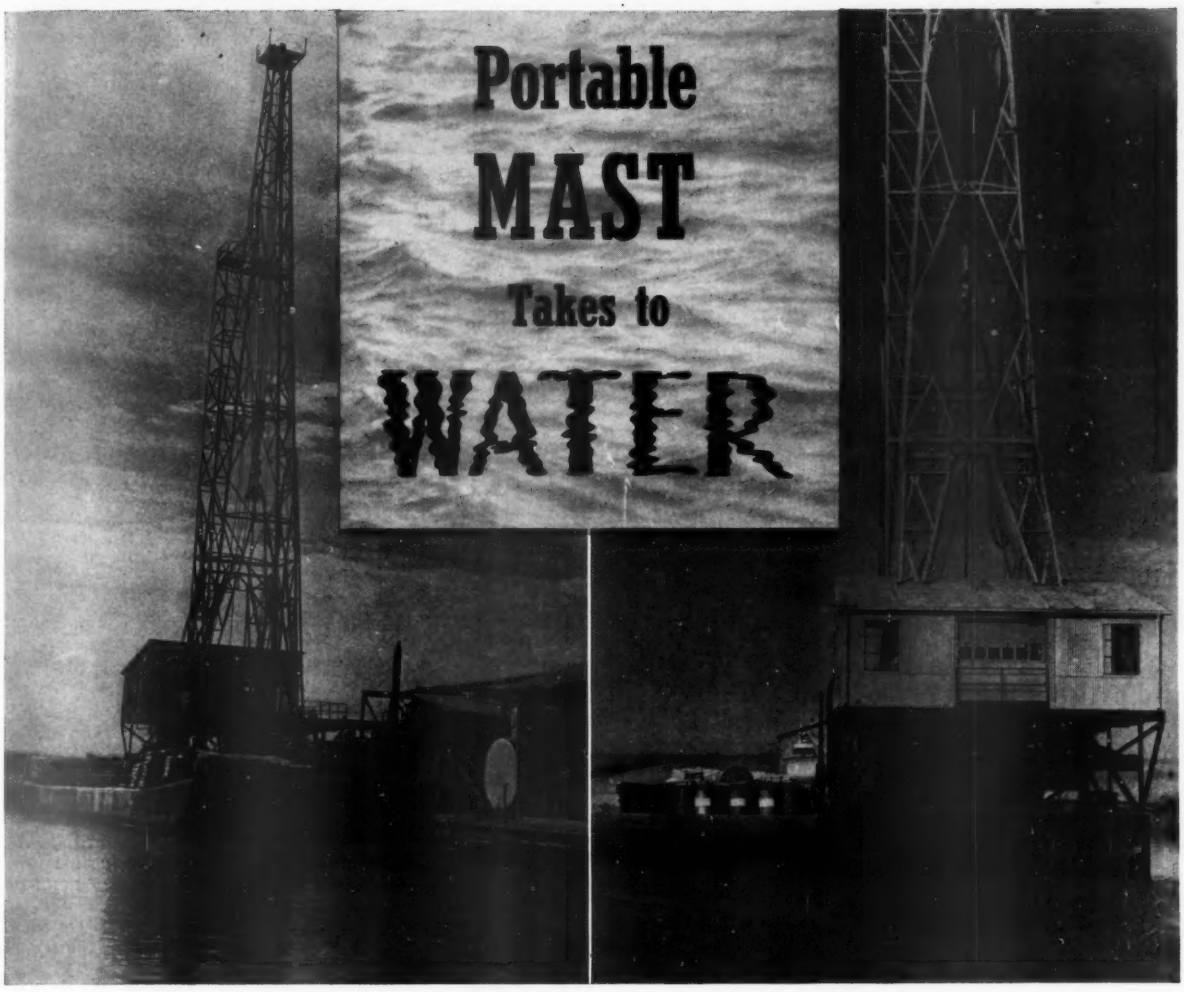

Fig. 1—(Left) Portable derrick workover barge operating in coastal Louisiana waters. Power barge at right houses diesel electric equipment. Rated horsepower of three diesel engines amounts to 745. Fig. 2—(Right) Notched end of workover barge permits hull to be spotted over well

by Paul C. Courtney*

THE recent adaptation of the portable mast to water operations by several Gulf Coast operators indicates that both physical and economic advantages which have been obtained for several years through the use of masts in land operations may also be obtained when the mast is applied to water operations.

On land operations a conventional-type derrick may be skidded to nearby locations; likewise, on water, the fully erected derrick may be towed to a new location. However, on water as on land, the use of the mast permits long moves with a minimum expenditure of time and labor. Much of the drilling and workover activity in coastal waters involves the movement of equipment through intercoastal canals, swamps, and marshes. One highline, one fixed bridge, or a short section of a canal where trees have grown together at the top will make the movement of a fully erected derrick along a proposed route impossible.

Incorporated into the design of the portable masts operating in coastal waters are two features which have contributed greatly to safety and efficiency. One involves the elimination of extensive interior bracing so that the driller can have a clear, unobstructed view to the derrick man. The other feature enables the driller to erect the derrick without having a slack line during the process.

The interior bracing, essential to support the front legs in all open-face masts, has been eliminated by lacing all four sides. This, of course, necessitates racking the drill pipe inside instead of outside the base. Since the space occupied by racked pipe is as great at the top of the stands as it is on the derrick floor it was necessary to design the mast so that the inside area at the working-board level would not only provide for free movement of the traveling block but would also accommodate the working boards and the full pipe setback. Space outside the normal cross section of the mast is required only on the side supporting the racked pipe; thence, the lacework is offset beyond the plane of the main legs, on that one face, up to the working board level. The result is a bulge which has a racking capacity of 108 stands of 4½-in. o.d. drill pipe or 143 stands of 3½-in. o.d. pipe.

In conventional masts a safety hazard is encountered during erection due to the hoisting line becoming slack when the center of gravity of the structure passes over the supporting pin. This condition is avoided in the bulge-type mast by a base design which causes the center of rota-

*Emsco Derrick & Equipment Co., Houston plant.

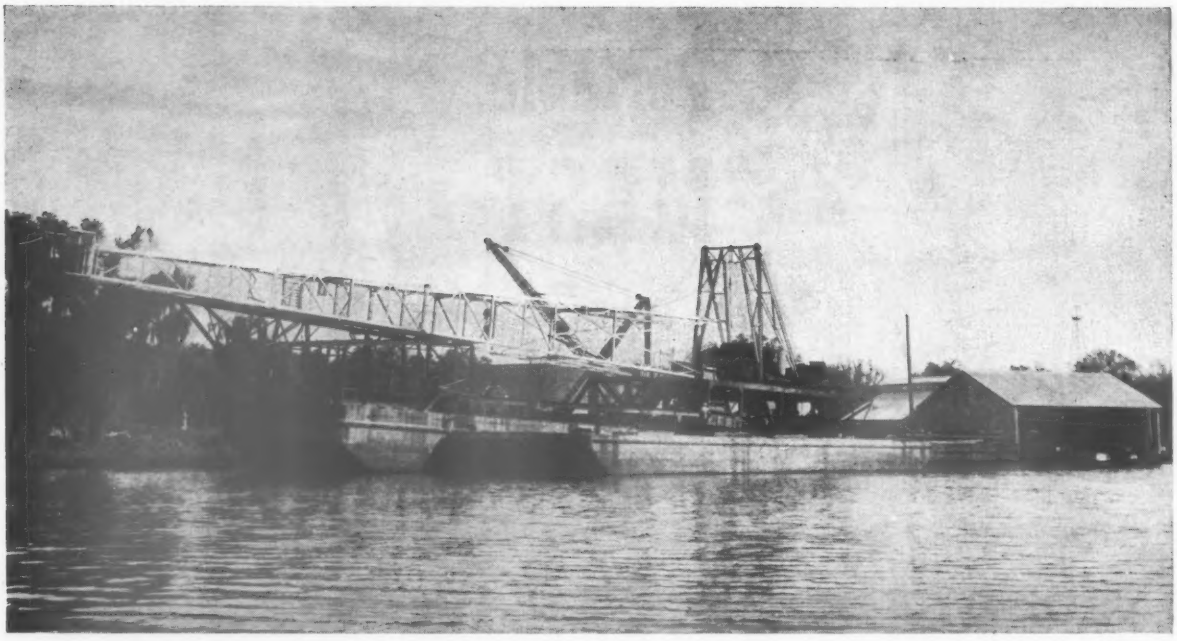

Fig. 3—Portable derrick drilling barge departs from Lafitte, La., to distant swamp location

tion to shift automatically from the front to the rear legs just before that critical point is reached. This eliminates the possibility of the mast falling back into the ginpole during erection and obviates the necessity of pulling it over center when lowering.

The working platform is the result of field tests with different boards. It is a double or split board designed for monkeyboard racking. The derrick man's position, with one foot on each board and straddling the slot or opening, places him squarely in front of the well in a favorable position to handle the elevators and stands of pipe. A stop, which may be bolted to either board, provides a rest for the pipe. The derrick man's position is such that he can step readily to either board, or back onto the heavy fingers, enabling him to move a stand of pipe to any location in the pipe rack with a minimum of effort. The boards are hinged and may be folded up against the face of the mast or they may be moved laterally. Fingers are hinged so that all, or as many as desired, may be tied up against the lacework; these fingers are adjustable as to position, thus permitting spacing to suit the size of pipe in use.

Two folding derrick workover barges have recently been placed in operation in the marsh area of southern Louisiana. These barges are approximately 130 ft. in length, about 30 ft. wide and 12 ft. deep and are built in the form of a U. Partitions within the hull provide compartments for submergence, mud, fresh water, and a dry well for pumping equipment. One of these rigs is powered by diesel-electric equipment; the other is a power rig.

The bulge-type masts on these barges can be raised or lowered in approximately 20 minutes.

Acryloid 150—Pour Point Improver

A NEW synthetic product developed during the war, it is understood, possesses to an outstanding degree the properties of depressing the pour point of a lubricating or other heavy-type hydrocarbon oil and of raising the viscosity index of the oil at the same time. This product is Acryloid 150, developed by Rohm & Haas laboratories, Philadelphia, for this purpose. Its composition has not been made public, but it is probable that it is a polymer, copolymer, or condensation product of some type, possibly an acrylic-acid derivative. It is supplied in a relatively viscous form for blending with the mineral-oil component.

Acryloid 150 is miscible in all desirable or necessary proportions with mineral oils of the lubricant type. It is chemically inert and does not react with the oil or other ingredients of the blend. It can be blended first with any other chemical or blending agents used in the product made, the whole then being mixed with the mineral oil. The normal amount added is 1.0 per cent to 1.25 per cent of this new material. One claim for its advantage is that its use reduces refining costs and the amount of wax necessary to remove for a given pour point, saving "useful" wax in the oil, thus improving yield on dewaxing. Claim is made that oils so treated show little tendency to revert to original, untreated pour point. This synthetic also raises viscosity index of oil to a considerable degree, although it appears that its chief value lies in its use as a pour depressant.

The following tabulated data show the changes in various properties produced by addition of Acryloid 150 to a lubricating oil of very high viscosity. The viscosity index increase is of the order of only about 15 per cent on this 114 viscosity index oil, while the pour point is depressed from +20° F. to —25° F., or a range of 45° F. The other properties mentioned are not affected.

Property	Mineral oil	Same oil plus 1.25% Acryloid 150
Viscosity SUS		
At 100° F.	152	172
At 210° F.	44	47
Viscosity index	114	130
Stable pour point (A.S.T.M.) °F.	+20	—25
Flash point °F.	420	420
Neutralization No.	0.08	0.08
Conradson, carbon residue	0.12	0.12

It is interesting to note the increase in the viscosity of this relatively light oil, from 152 to 172, or 13+ per cent, calculated from zero.

Hundreds of tests have been made with this product, developers assert, and it has proved stable both in its chemical composition and reactions, and in its effects on oil properties. A new Acryloid family development is under way, statements by Rohm & Haas indicate, which shows greater improvement in viscosity index. Development is directed to obtaining greatest viscosity at high temperatures.

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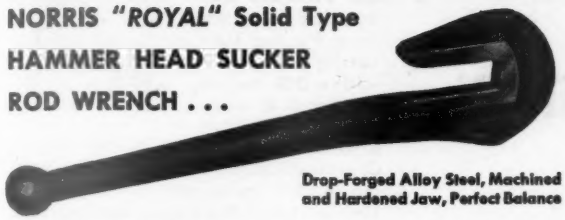

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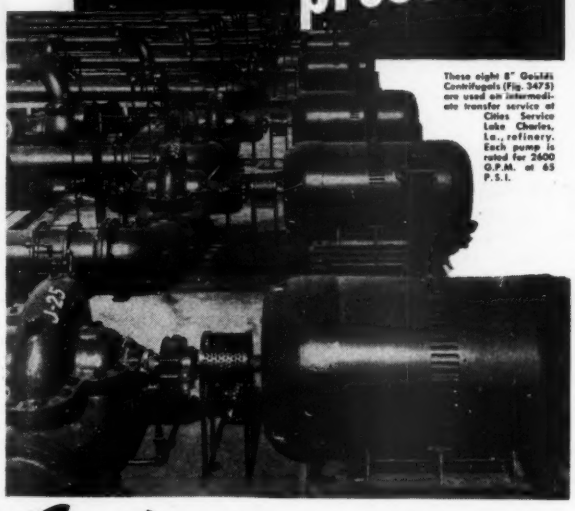

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Midget Fluid Cat Cracker Makes Process Economical For the Smaller Refinery

by Davis Read

THE majority of the catalytic-cracking units constructed during the war had a nominal capacity in excess of 10,000 bbl. per day, although a number of smaller units of 4,000-5,000 bbl. per day capacity were also operated very successfully to produce aviation gasoline components. The smallest fluid catalytic-cracking unit, having a capacity of 2,600 bbl. per day, has been in operation for nearly 2 years and is presently producing motor fuel. A considerable amount of development work was done on each of these units for the purpose of increasing throughput and improving the efficiency of operations to produce the maximum amount of aviation gasoline components. The data thus obtained have permitted a revision of the original factors used in the design so that it is now possible to build less-expensive, more-efficient equipment to produce high-quality motor fuel.

The 2,600 bbl. per day unit took advantage of revised design factors to some extent and incorporated several features which have proved advantageous in the construction of

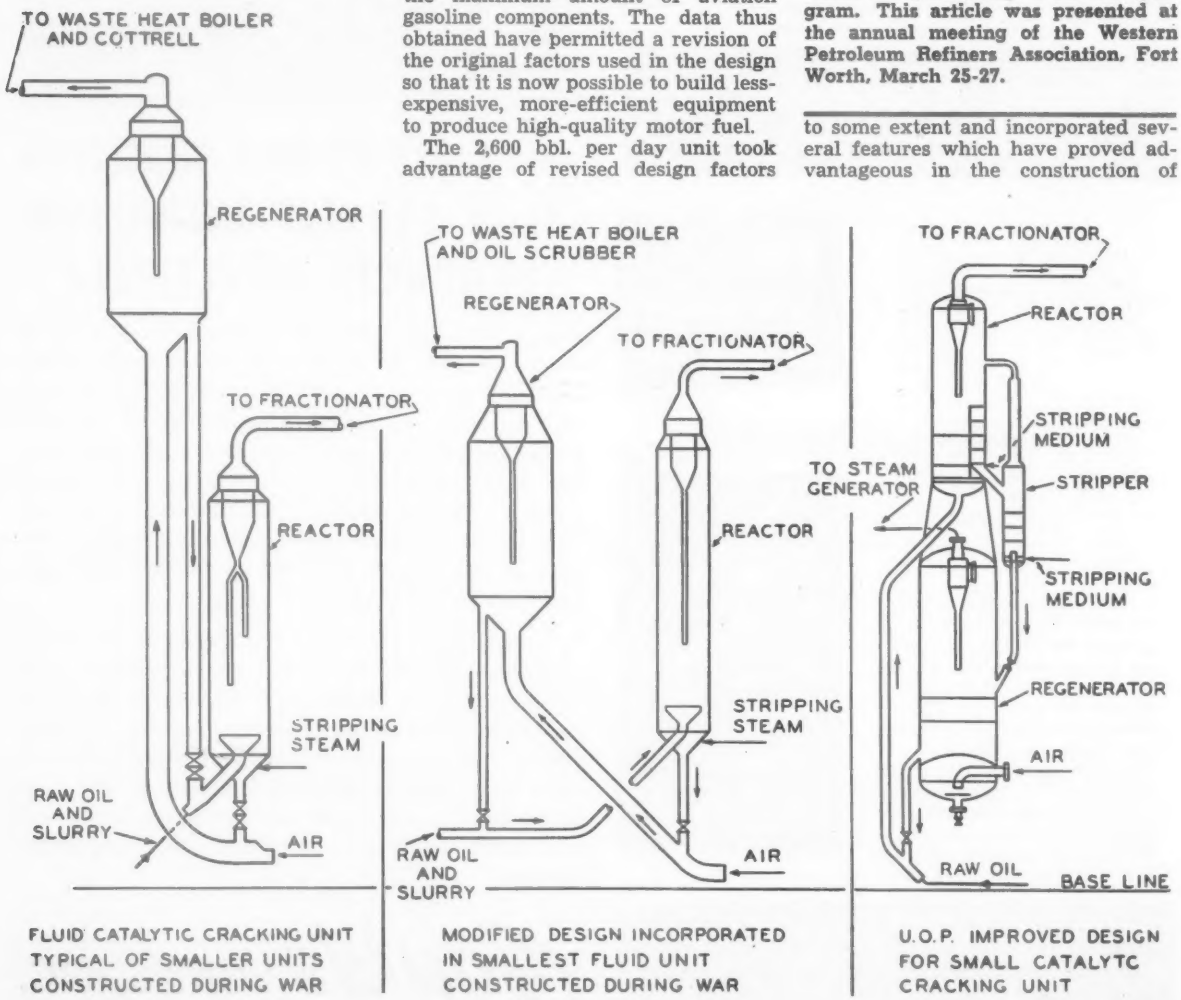

Fig. 1

THE AUTHOR

Davis Read, a member of the commercial development department of Universal Oil Products Co., was graduated from Purdue University in 1936 with a B.S. degree in chemical engineering. Upon graduation he joined Reilly Tar & Chemical Corp. of Indianapolis, leaving in 1937 for a year of study at the University of Michigan, leading to a M.S. degree in chemical engineering. He joined Universal in 1938. His work with this company has been in various phases of research and development, including pilot-plant investigations. In the service department during 1943-1945 he was engaged in the operation and supervision of 100-octane gasoline plants which were Universal's responsibility in the war program. This article was presented at the annual meeting of the Western Petroleum Refiners Association, Fort Worth, March 25-27.

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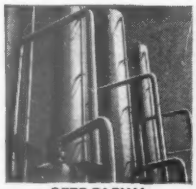

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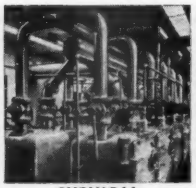

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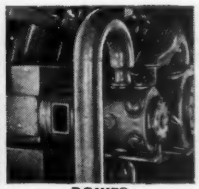


POWER

EQUIPMENT

small units. The present simplified U.O.P. design has been a logical development of the fluid cracking process, as illustrated in Fig. 1. These flow diagrams show briefly the stages in the development of the present simplified unit.

Development of Mechanical Design

The left-hand portion of Fig. 1 shows the typical downflow type of construction which was embodied in many of the smaller (5,000 bbl. per day) fluid-cracking units operated during the war. The raw oil enters the system at the base of the regenerated catalyst standpipe. The heat in the catalyst vaporizes the oil and the mixture of oil vapors and catalyst flows upward through a riser into the reactor. The vapor velocity is such that the catalyst suspended in the oil vapors falls back and forms a dense layer on the grid plate. The term "downflow" originates from the fact that the catalyst partially separates from the oil by gravity and flows downward out of the bottom of the vessel. The oil vapors pass through this dense catalyst bed where the cracking reaction takes place and the cracked products then pass through a centrifugal separator where entrained catalyst is removed. The vapors then pass to a fractionating column where the desired products are separated. Since the fine catalyst powder used in these plants cannot be entirely retained by the cyclones, it is necessary to return the catalyst carried into the fractionator to the cracking section by recycling tower bottoms or slurry oil.

The spent catalyst leaving the reactor is stripped by steam to remove entrained oil vapors and then descends through a standpipe to the point where air is introduced. The air required for burning the carbon formed in cracking carries the spent catalyst up through a long riser into the regenerator. Both the riser and the regenerator are lined with refractory brick. The catalyst separates by gravity, settles back into a dense fluid phase and flows downward through a standpipe to meet the incoming raw oil. The products of combustion pass out through cyclones to remove entrained catalyst, through a waste-heat boiler and finally through a Cottrell precipitator where most of the remaining catalyst is recovered. The fines recovered from the Cottrell are returned to the regenerator.

Thus it is seen that there are three principal flowing streams in the fluid process:

1. The oil passes through the reactor to the fractionator.

2. The air for regeneration of the catalyst passes once through the regenerator.

3. The catalyst itself circulates within the system.

The catalyst circulation rate depends upon the pressure differential across the slide valves. The higher pressure above the slide valve is the sum of the pressure in the top of the vessel and the static head created by the dense catalyst in the vessel and standpipe. In this type of unit the regenerator pressure is fixed by the back pressure on the outlet line at 1 to 4 psi., depending upon whether or not a restriction grid is installed in this line. The pressure above the slide valve then depends largely on the catalyst density in the vessel and standpipe. The pressure below the slide valve is low because of the lower density of air, or vapors, and catalyst in the riser.

It was found that the catalyst finally developed and used during the war increased considerably in density during service; consequently, the pressure drop available for causing circulation was much greater than the design basis. Since more pressure drop was available than that required for the specified cracking operation in the original downflow units, it follows that the static head or over-all height of the regenerator can be decreased, thus decreasing the installation cost. For the smaller units it is also entirely feasible to install a pressure-control valve in the regenerator outlet and operate this vessel under pressure, again decreasing the height of the vessel above grade. These two features were incorporated in the design of the 2,600 bbl. per day unit.

The center section of Fig. 1 shows a flow diagram of this modified design. The reactor pressure is approximately 9 psi. in this modified unit and the regenerator pressure is about 10 psi. Aside from permitting a decrease in the over-all height of the regenerator, the higher regenerator pressure results in an improved carbon burning rate. Even though the over-all height was decreased from 180 ft. in the original downflow design to 100 ft. in the modified design, the available driving force is still more than required for good catalyst circulation. This unit has circulated catalyst successfully with 2 to 3 psi. pressure drop across each slide valve, although the available pressure drop is much greater.

Several other improvements in design for smaller units were incorporated in the 2,600 bbl. per day unit. The Cottrell precipitator was replaced with an oil scrubber which removes the catalyst fines from the regenerator gases almost completely. The risers do not contain refractory lining which has caused some difficulty in other units.

The right-hand section of Fig. 3 illustrates the newer fluid-catalytic-cracking unit design which includes the improvements previously described, as well as several additional features which increase efficiency. Since commercial tests show that it is entirely feasible to operate with a slide valve pressure drop of 3 psi., the next logical step is to lower the larger regenerator vessel still further. This permits the regenerator to be placed below the reactor and in smaller sizes the reactor can be supported by the regenerator, thus eliminating the heavy structure required for support in the older design. The over-all height of a 3,300 bbl. per day unit is approximately 125 ft.

Briefly, the flow through this unit

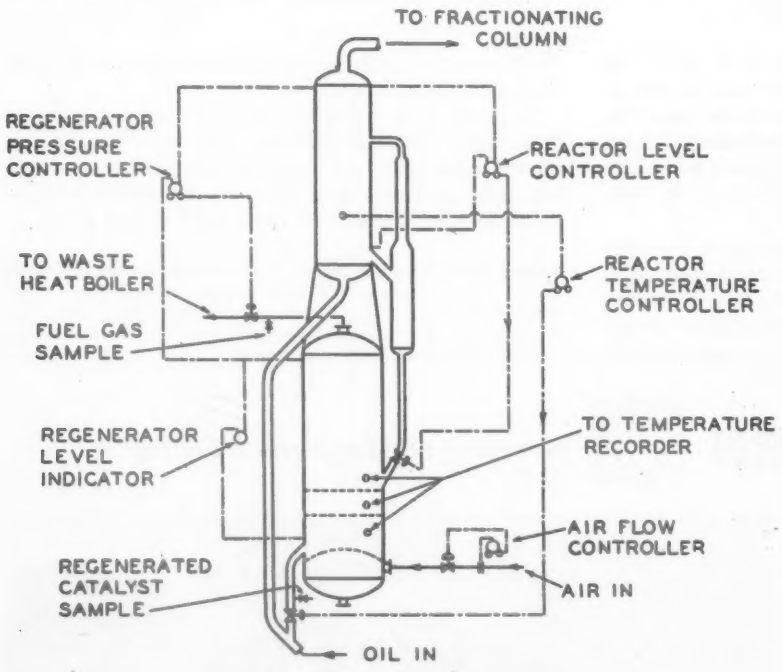


Fig. 2

is as follows: The oil feed is charged as a liquid at the base of the reactor riser, hot catalyst from the regenerator enters the riser at the point of oil injection, supplies the process heat requirements and is transported upward by the vaporized oil into the reactor. Spent catalyst is continuously withdrawn from the upper part of the reactor dense phase to hold a level in the reactor and passes downward through the stripping section into the regenerator. Three zones are available for stripping in this design. The stripping medium is injected at the bottom of both the internal and the external strippers. Additional stripping of the spent catalyst is obtained in the upper section of the regenerator where the bulk of the flue gas from the combustion of coke in the lower sections contacts the incoming catalyst. The catalyst passes downward through the regenerator countercurrent to the air supplied at the bottom for regeneration.

Regenerated catalyst flows from the lower section of the regenerator to the reactor riser at a rate controlled to maintain a constant reactor temperature. The regenerator flue gas is vented to the atmosphere through an internally mounted cyclone separator which recovers entrained catalyst. The reaction products pass to the fractionator through an internally mounted cyclone separator which recovers entrained catalyst and returns it to the catalyst bed. A comparison of the three diagrams in Fig. 1 will show that the principle of catalyst circulation from one vessel to another by transfer from a zone of high density through a zone of low density is the same in all three units.

It has been demonstrated that the installation of distribution plates improves the efficiency of contacting of oil and catalyst in the reactor resulting in a higher liquid recovery and less gas formation. The installation of additional grid plates in the regenerator and stripper results in an improved carbon burning rate and stripping efficiency with a decrease in operating costs. These improvements have been incorporated in the new design.

By building the regenerator below the reactor it is now possible to pass the air for regeneration countercurrent to the flow of catalyst. With the countercurrent flow and staging of the regenerator with grid plates the oxygen content of the outlet gas can be reduced to ½ to 1 per cent while

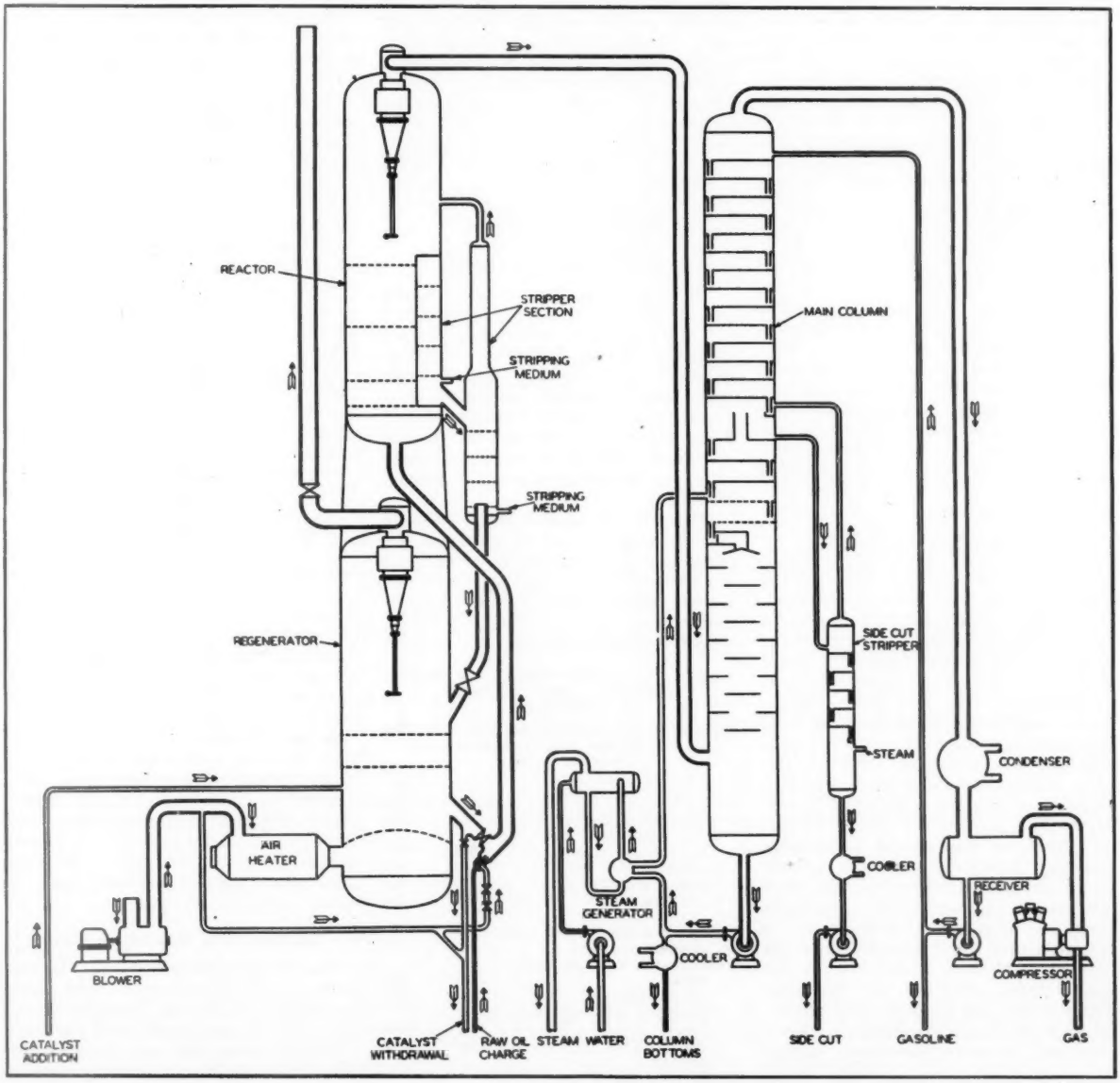


Fig. 3

in previous units two to three times as much unused oxygen normally escapes from the regenerator. This feature of the new design was not possible in the older units. A detailed discussion of these improvements in efficiency which have been incorporated in the new design has been previously given in the literature.*

Control of Operations

Fig. 2 illustrates the system used for controlling the operation of the simplified unit. The reactor temperature controls the flow of catalyst through the regenerated catalyst slide valve and the reactor level controls the flow through the spent catalyst slide valve. The reactor pressure is held constant by the gas compressor and the regenerator pressure is held constant by the rate of release of flue gas, with the valve in the flue gas line controlled by the pressure difference between the reactor and regenerator. This method of control is used on the 2,600 bbl. per day unit and has several advantages. The pressure drop across the slide valve does not vary appreciably since both the vessel pressures rise and fall together in the event of surges in either the air or gas compressors. The catalyst flow is very uniform and responsive to changes made in the instrument. The cracking reaction, as measured by the per cent yield of cycle stock or by the gas rate, is controlled at constant throughput by varying the reactor level or temperature. An increase in either the reactor level or the temperature increases the conversion. In order to control the burning reaction an analysis of the regenerator outlet gas stream is obtained and the carbon content of the catalyst is determined periodically. The regeneration is then controlled by varying the air or carbon production rate.

Catalysts

The simplified unit can utilize either synthetic or natural catalyst. In its most simple design synthetic catalyst having a microspherical form is used. Due to the spherical shape of the particle and its greater strength, as compared with the ground powdered catalysts used during the war, this catalyst has very low erosion and attrition rates. In addition, the M.S. catalyst is much more uniform in particle size than the ground catalyst. This permits the design of this unit without the use of secondary-recovery equipment such as a Cottrell or oil scrubber or slurry pumps. Two synthetic microspherical catalysts composed of either silica-magnesia or silica-alumina are available. Since the natural catalyst is lower in cost per pound than either of the synthetic catalysts, its use must also be considered. When natural catalyst is used, however, secondary-recovery equipment must be added to the M.S. unit. This equipment consists of an oil scrubber or Cottrell to recover the fines from the regenerator outlet gas and pumps to return catalyst slurry from the fractionator to the reactor.

Economic consideration of market requirements and operating costs will govern the choice of catalyst. The silica-alumina catalyst gives the highest octane number and lowest gasoline yield while considerably more gasoline having a lower octane number is produced from the silica-magnesia catalyst. The natural catalyst gives a gasoline yield and octane rating intermediate to the values obtained by the two synthetic catalysts.

The catalytically cracked gasolines produced from each catalyst have blending octane numbers considerably higher than their rated values when blended with straightrun gasoline. This blending value varies with the quality of the straightrun and per cent of catalytically cracked gasoline in the blend. For example, a catalytic gasoline having an A.S.T.M. octane rating of 81 would have a blending octane rating of 89 A.S.T.M. when blended with 70 per cent of straightrun having a 53-octane rating. The research method blending value of the catalytic gasoline would be approximately 110 in this example.

Methods of Processing

The flexibility of the fluid-cracking process has been well demonstrated by units now in operation. Various charging stocks, including naphtha, kerosene, gas oil, and topped crude have been processed commercially at temperatures ranging from 800°-1,000° F. in either once-through or recycle operation. This same degree of flexibility can be obtained in the improved M.S. unit.

With the present limited gasoline and maximum fuel-oil demand the operation of a catalytic-cracking unit at extremely high conversion does not appear advantageous. To meet present market demands a refiner would, therefore, probably operate a fluid catalytic-cracking unit at an intermediate conversion level of 55-65 per cent to produce both gasoline and burner oils. Since the cracking reaction can be controlled by varying the amount of catalyst in the reaction zone, it is possible to return a part of the cycle stock to the reactor without reducing the net yield of cycle stock. By reducing the level of catalyst in the reactor and recycling a part of the cycle stock, the conversion per pass is decreased. This operation increases the gasoline and butylene yield and decreases the yield of dry gas and butanes, as shown in Table 1. The decreased conversion per pass reduced the A.S.T.M. (F-2) octane numbers of the debutanized gasoline, but had no indicated effect on the Research (F-1) octane ratings at the conversion and temperature level under which these tests were made. Note that the cycle stock became lighter in gravity in going from once-through to recycle operation at a constant conversion or yield of cycle stock.

TABLE 1 — COMPARISON OF ONCE-THROUGH AND RECYCLE OPERATION

Fluid-Catalytic-Cracking Mid-Continent Gas Oil—65 Per Cent Conversion, Natural Catalyst

	Once-through	1.67 C.F.R.
Yields, Vol. %:		
Debutanized gasoline, Vol. %	48.9	50.5
Cycle stock, 400° F.+, Vol. %	35.0	35.0
Butylenes, Vol. %	5.8	6.5
Butanes, Vol. %	7.4	5.5
C_3 and lighter, wt. %	6.6	5.4
Debutanized 400° F. end point gasoline:		
Octane No. A.S.T.M. (F-2):		
Clear	80.3	79.2
+3 cc. TEL	86.5	85.5
Octane No. Research (F-1):		
Clear	90.8	90.8
+3 cc. TEL	96.5	96.5
Cycle stock, 400° F.+:		
Gravity, °A.P.I.	26	28

As previously described, the heat required to vaporize the raw oil in the fluid catalyst process is supplied largely by direct heat transfer between the raw oil and the hot regenerated catalyst. The simplest design of the new unit is, therefore, based on processing a given amount of liquid feed in once-through operation at conditions under which there is a balance between the heat released in regeneration and the heat absorbed in processing.

A unit designed for once-through operation can, of course, recycle at a lower raw oil throughput than the maximum capacity obtainable in once-through operation. The limiting raw oil throughput may be set by the size of the reactor or fractionator since certain maximum vapor velocities cannot be exceeded in these vessels. Further it is necessary to supply additional heat to the reactor when recycling in order to maintain a heat balance in the catalyst section. This is usually done by installing a preheater on the feed to the reactor, although some raw oil preheat may be obtained by heat exchange with the fractionating column bottoms.

A unit designed for recycle operation will cost somewhat more than a unit intended to process the same amount of oil in once-through operation at the same conversion. However, the increased liquid recovery obtained by recycling will offset the additional capital expenditure in many cases.

Utilities and Operating Costs

The utility requirements for the improved unit, of course, depend upon the type of operation, charging stock, and type of equipment used for heat exchange, pumping and compression. As a basis for discussion, the normal utility requirements were estimated

*The Oil and Gas Journal, Vol. 44, pp. 77-80, 84-88, Anderson & Sterba.

for the catalyst and fractionating sections of a 2,000 bbl. per stream day unit processing Mid-Continent gas oil at 60 per cent conversion in once-through operation.

The utilities required to operate this equipment, which is illustrated on Fig. 3, are summarized in Table 2. The total steam required amounts to 4,000 bbl. per hour, but 5,500 lb. per hour of steam is produced from the column bottoms steam generator, resulting in a net steam production of 1,500 lb. per hour. All of the pumps shown on this diagram are driven by steam and the air compressor is driven by a gas engine.

The total heat available in the fuel gas produced after polymerization would amount to 31 million B.t.u. per hour. It is estimated that 3 million B.t.u. per hour of fuel gas would be used in driving the gas compressors required to feed the low pressure receiver gas into an absorber operated at 200 psi. An additional 5 million B.t.u. per hour of gas is used for compression of the regenerating air. The net fuel gas available for the boiler house, or heating in other sections of the refinery, thus amounts to 23 million B.t.u. per hour. The total cooling water for the condenser and coolers amounts to 500 g.p.m. The electricity required for lights and power is estimated at 15 kw.

Using these utilities as a basis, the estimated cost of operating the equipment shown on Fig. 3 is summarized in Table 3. The total cost of operation amounts to 29.3 cents per barrel of raw-oil charge. Credit was taken for the net steam production in these calculations, but no credit was taken for the fuel gas production. With the operation of a stabilizer and absorber to prepare debutanized gasoline and a liquid C_3-C_4 feed to the polymerization unit, total operating cost would be approximately 33 cents per barrel.

TABLE 2—ESTIMATED NORMAL UTILITY REQUIREMENTS—2,000 BBL. PER STREAM DAY CATALYTIC-CRACKING UNIT

Basis: 60 Per Cent Conversion Mid-Continent Gas Oil—Catalyst Section and Fractionator Through Gas Compressor

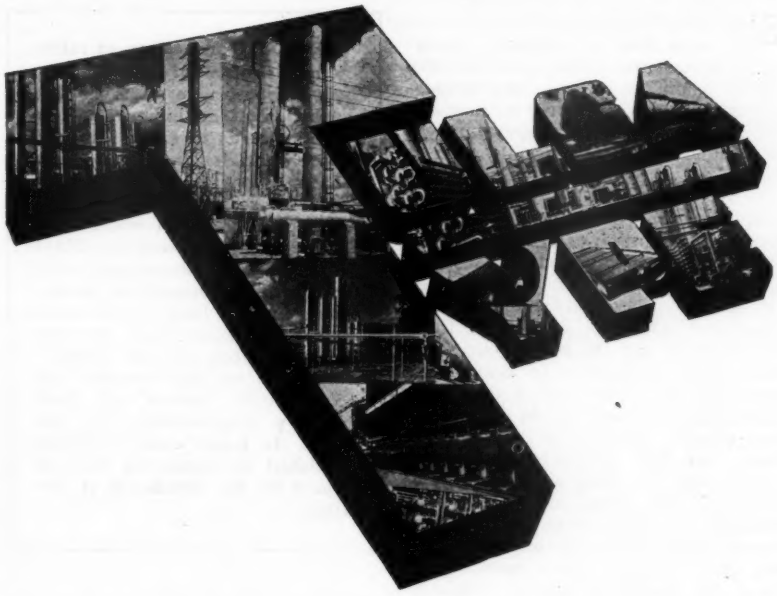
	Lb./hr.
1. Steam:	
Required (150 psi.):	
Pumps	3,000
Stripping	1,000
Total	4,000
Produced (150 psi.):	
From column bottoms steam generator	5,500
Net produced	1,500
2. Electricity:	Kw.
Lights and power	15
3. Fuel gas:	MM B.t.u. per hour
Required:	
Gas compressor	3
Air compressor	5
Total	8
Produced:	
After polymerization	31
Net produced	23
4. Cooling water (85° F. max. inlet):	
Main condenser	250
Gas compressor cooling	150
Cycle oil coolers	100
Total	500

TABLE 3—SUMMARY OF OPERATING COSTS—2,000 BBL. PER STREAM DAY FLUID-CATALYTIC-CRACKING UNIT

Basis: 60 Per Cent Conversion Mid-Continent Gas Oil—Catalyst Section, Fractionator, and Gas Compressors

Item	$/CD
1. Operating supervision:	
Foreman at $350 per month	11.70
2. Operating labor:	
1 operator at $1.50 per hour, 24 hours	36.00
2 helpers at $1.25 per hour, 48 hours	60.00
3. Utilities:	
Steam, 1,500 lb. per hour at 25 cents per M. lb.	8.10
Fuel gas, 8.0 M.M. B.t.u. per hour at 15 cents per M.M. B.t.u.	25.90
Water, 500 g.p.m., 1 cent per M. gal.	6.50
Electricity, 15 kw. at 1 cent per kw.	3.20
4. Catalyst, ½ lb. per B.C.D. chg. at 15 cents per lb.	135.00
5. Maintenance (labor and materials)	100.00
6. Laboratory:	
1 tester, 24 hours at $1 per hr.	24.00
Chemicals, materials, etc	10.00
7. Royalty, 1,800 B./C.D. at 5 cents per barrel	90.00
8. Taxes and insurance	35.00
Total	528.20
Cost per barrel of charge, cents	29.3

*Credit.



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7. How Effective Is Your Program of Safety Inspection?

by George Armistead, Jr.

PERIODIC inspection of refinery equipment is made for two purposes: to discover the condition of equipment, and to make records to show rate and history of deterioration and time of replacement. Standard procedures are arranged which are calculated to detect weaknesses with reasonable certainty. Older processes have developed well-standardized inspection procedures from long experience; newer processes must develop these methods further. Inspectors must be well trained and experienced, aware of their heavy responsibility to the plant. In many cases extremes of detail in inspection will be repaid by the avoidance of disaster.

STANDARDIZED practices for safety inspection of refinery equipment came into being in the early 1920's when the use of high temperatures and high pressures became extensive. Although oil temperatures at that time did not generally exceed 900° F. in thermal cracking processes where pressures up to 500 psi. were employed, it soon became evident that the prevention of disastrous fires, frequently accompanied by loss of life, would require two things, namely, (1) the use of suitable materials employed with due regard for their capabilities, and (2) continuous scrutiny of the equipment to assure that corrosion or other effects were not impairing its condition to a dangerous extent. Since those early days, much has been learned about materials along the lines of corrosion resistance and long and short-time strength at high temperature, while standardized design methods embodying this knowledge have been developed for many kinds of refinery equipment, of which the A.P.I.-A.S.M.E. Code for Unfired Pressure Vessels is one example. Likewise, inspection and testing methods were developed which would show the fitness of processing units, these usually taking the form of standardized procedures which were proven by experience to bring out any possible defects. While these developments were primarily on processing units, the same methods were applied in a general way to other refinery elements such as tankage, loading racks, drainage and traps, filling plants, and other locations where hazards of fire and/or explosion exist. As a result, the inspection department became a full-fledged unit in the refinery organization and has been responsible for much of the safety and continuity of operations on processing units. It should be noted here that other important contributions to refinery safety have been in safety standards of design, including such items as proper relief valve and blowdown facilities, safety devices, and the like; and in safety standards of procedure which has involved the education of refinery personnel in the hazards associated with their jobs and the corresponding safe practices which anticipate them. These latter phases are not within the scope of this paper.

Objectives

The two immediate objectives of refinery equipment inspection are (1) to determine the condition of the equipment, and (2) to record it, in order to trace the history of deterioration and permit a replacement in time. In all modern refinery equipment employing elevated temperatures, as well as in other refinery equipment, thorough and systematic inspection practice is indispensable to safety of workers and continuity of operations. The critical point in the first-mentioned of the above objectives is the locating of the limiting point of weakness of a system, and the inspection is, in fact, a search for such point or points, existing or potential. The basis of effective inspection is standardization on a procedure which experience has shown will uncover weaknesses with reasonable certainty, plus competent and diligent direction to cover any possible loopholes in the standardized procedure. The nature of refinery corrosion and erosion includes many different types of effects, the reasons for some of which are discernible and for others are not. For example, failures have resulted in many instances on high-temperature dead-end pipes or nipples attached to a source of pressure; extraordinary corrosion has sometimes shown up in short sections of high-temperature vapor line where some cooling occurs and the variation in tube corrosion throughout a furnace coil is very marked. Such effects as these might not be looked for, without experience. The standardized procedure and the initiative of the inspector are both necessary to uncover the limiting point of weakness. It is obviously unwise to rely wholly on a set of rules in such a search but it is also undesirable to require the inspector to carry the whole burden of experience which would be embraced in a standardized procedure.

Standardized Procedure

Inspection at regular intervals applies in the main to the process equipment, although almost every other part of the refinery requires inspection at some intervals, especially tankage. While refiners generally have a vast backlog of experience in locating unsafe parts in the equipment they have been operating over the past 25 years such as crude units, thermal-cracking units, gas-recovery and stabilization plants and the like, the advent of many newer types of equipment in the war years and those just preceding, such as catalytic cracking, alkylation, isomerization, and hydroforming is requiring extensive checking of the corrosion effects and other hazards individual to these units. The employment of mineral acids in some of these processes, which are normally in fairly noncorrosive forms, but may become

highly corrosive by misoperation, heightens the requirement for such study.

Some refiners have their standardized inspection procedure in comprehensive manuals or other written outlines which detail the inspection work required on various classes of equipment, indicating that which must be done at stated times (as required by experience) and that which may be done at the discretion of the inspector. In some cases the manuals include the various standard data and methods used in calculating the strength of various parts such as tubes, header fittings, vessels, and the like. A partial composite of such manuals is that issued by the Petroleum Administration for War in 1945 entitled "Wartime Recommendations for Refinery Inspections," the content of which was contributed by inspection personnel of various oil companies. An adequate manual or its equivalent in written inspection procedure is considered an essential for continued safety on most classes of refinery equipment, especially process equipment.

As mentioned previously, the inspection of a refinery unit is for the purpose of determining in detail the condition of all its parts, the rates at which corrosion and erosion are proceeding, and the conditions under which it is safe to operate the unit until the next shutdown for renewals. Important incidental objectives are the location of parts requiring corrosion protection and any defects bearing upon operations as a potential cause of shutdowns or reducing the efficiency or increasing the cost of the operation. The periodic inspection period is likewise important as a reconditioning period. A given inspection period may cover an entire processing unit, as in the case of the smaller closely integrated installations, while in others as in the larger, more complex units a given inspection period may cover only a part of the unit, with other parts being inspected at successive down periods.

Scope

The general scope of such an inspection includes:

A. Visual inspection.—This is to determine the apparent condition of all equipment, welds, riveted joints, corrosion, etc., on the entire unit. It also includes the inspection, testing, and reconditioning of automatic safety devices such as liquid-level alarms, differential pressure and oxygen-content emergency devices, pH alarms, emergency shutdown and dumping systems and the like, which are important on many modern types of units.

B. Hammer testing.—This is a secondary but sometimes important means of locating any otherwise undetected thin sections in piping, nozzles, nipples, vessels, and elsewhere.

C. Measurements.—This covers the measurements of all points called for by the standard inspection procedure, including various locations in vessels, piping, valves, furnace tubes, and miscellaneous parts subject to corrosion and erosion. It may involve calipering through accessible openings or may require drilling and calipering of the parts. A new technique in measurement of wall thicknesses is the Penetron employing radioactive materials in a measuring instrument which eliminates the need for drilling and will presumably increase the speed and practical scope of inspection.

D. Corrosion-resistant linings.—This is to determine the condition of and extent of protection being afforded by all linings. The type of inspection varies with different linings, the welded alloy liners requiring visual examination, sometimes with a glass, to determine if cracking or corrosion may be occurring, and hammer testing to locate any looseness from the main plate. Various types of cement, gunite, plastic, brick, and similar liners require visual examination, and it is frequently good practice to make the inspection period the time for complete removal of such liners both for the sake of renewal and for inspection of the plate behind them.

E. Pressure tests. — These are for the purpose of confirming the tightness of welds and joints and to check the suitability for the required operating conditions. Various types of pressure tests are employed, but are mainly hydrostatic for the high-pressure equipment. In some isolated cases such as the large catalytic-cracking vessels where the actual weight of water for testing would be prohibitive, testing with air is sometimes authorized. Included in this general division is the reconditioning and pressure testing, where necessary, of the relief valves of the unit, a very important feature of the inspection.

F. Records.—These must accurately cover the condition of the equipment as found in the inspection and furnish the basis for calculating rates of deterioration. Since the records are the principal medium for utilizing the results of the inspection, their accuracy is very important, and requires close attention both in entering the measurements and other data as they are taken in the field, and in their review and final interpretation by the supervising engineer or inspector. The various forms of recording inspection data are well standardized, and examples are shown in the PAW publication mentioned above. The end result from the analysis of the inspection data as it is obtained is, of course, the replacement and repair of such elements of the equipment as are indicated would go below the required standards before the next scheduled reconditioning time. Many factors enter into the decisions as to the actions to take on the basis of inspection data, which are generally relatively easy if the full facts on equipment condition have been obtained.

Organization

Inspectors should be individuals properly qualified by both training and experience and with a full appreciation for their responsibility in maintaining safety of equipment. The inspection department should not be under the control of the operating department because of possible influencing of decisions by production considerations. It is generally found feasible for the inspection department to be responsible to the plant management for the maintenance of safety with the provision it can be overruled only by the management or its representatives.

There is occasional suggestion that certain phases of standardized inspection procedure are too arduous and without justification for the time and expense required. It is true that short cuts can be taken or omissions made without undesirable effects in many instances. However, no measures are too arduous that mean additional protection against serious accidents, and the type of defects that are uncovered by extremes of detail in inspection and testing procedure are those unexpected and less frequent ones that may be as serious as any other. Such defects may develop from maintenance work, such as the inadvertent welding in of thin sections or improper materials in high-pressure equipment, faulty tube rolling, or the like, as well as from deterioration. Since they cannot be anticipated, the safety of the equipment has to be protected by setting up definite inspection rules which are known to permit the uncovering of this class of defects, so far as is possible. The more thorough inspection procedures which are in use are based upon the rules found essential through long and sometimes bitter experience with the operation of many types of refinery units, during which time the means necessary to detect various classes of defects and weaknesses have become apparent. However, with all the rules that may be formulated, the prime basis of safety must always rest on the ability, diligence, and thoroughness of the inspectors and their support and careful supervision by the refinery management.

Gordon Loud, archeologist, has joined Atlantic Refining Co. and has been named its Middle East representative, with headquarters in Cairo. Now en route to Naples and Alexandria, Loud is slated to begin a survey of Middle East oil activities for Atlantic Refining.

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PROGRESS IN METALS

by W. L. Nelson
Consulting Engineer

Resisting Hydrochloric Acid

MATERIALS that can withstand the corrosive effect of hydrochloric acid, other halogen acids (hydrobromic and hydrofluoric), and many chlorides, bromides, and fluorides are rare. With respect to hydrochloric acid the only common metallic materials that are entirely satisfactory are silver and tantalum. These are expensive and hence there is a constant search for cheaper materials. Glass, ceramics ware and high silicon irons which contain 4 or more per cent of molybdenum are among the cheaper materials that can handle concentrated and hot acid but these materials are so brittle that they cannot be used for most commercial applications. Even glass does not withstand the action of hydrofluoric acid, but a special phosphate glass has been developed (Glass Industry, Vol. 25, Dec. 1944, p. 548). Certain plastics such as Haveg and Saran can be used for concentrated acid but they cannot be used at elevated temperatures. In an effort to avoid the high cost of silver, it has been widely used as a lining material and more recently Lukens Steel Co., which has long been active in developing "clad" steels, has been furnishing silver-clad steel. In this steel the silver layer is bonded to the steel to give a strong corrosion-resistant and relatively cheap material. With respect to tantalum, effort has been directed mainly to the development of unique designs (The Oil and Gas Journal, May 19, 1938, page 87, and April 21, 1938, page 58) which employ thin sections or require a minimum amount of this expensive metal. Extremely thin sections may be used except for exceedingly high pressures because an allowance is seldom required for thinning by corrosion. Obviously platinum, gold, and tungsten also belong in this group.

Common materials.—For less severe conditions, particularly concentrations of 10-20 per cent and at temperatures well below the boiling point, a number of cheaper but still somewhat expensive materials have been developed. Prominent among these are the molybdenum-silicon cast irons. Without molybdenum the 14-16 per cent silicon irons (J. E. Hurst, Acid-Resisting Cast Iron, Foundry Trade Journal, Vol. 71, p. 283, Dec. 9, 1943) can be used at low temperatures. Upon the addition of 3 to 5 per cent molybdenum (K. T. Vashenko, the Russian journal Zuhr. KHIM. Prom., Vol. 15, No. 2, 1938, p. 39) the iron may be used for hot acid providing the concentration is under about 15 per cent. For greatest corrosion resistance the silicon irons should lie within the solid solution area of the equilibrium phase diagram up to a silicon percentage of 15.7. Most of these irons are only about half as strong as good-quality gray cast iron and they are considered as too brittle for many applications.

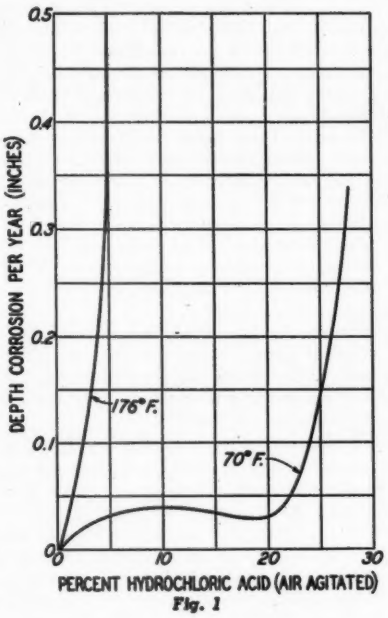

Fig. 1

Another group of materials may be considered as nickel alloys which contain large amounts of molybdenum, usually contain some iron, and may contain various but usually smaller amounts of chromium, manganese, tungsten, or copper. Examples of such alloys, or modifications of them, are Hastelloy A, B and C, Worthite. Illium, Contracid 7M and 10W, La Bour G60, etc. Most of these alloys can be worked and fabricated by regular methods and except for the somewhat high cost of the special metals employed, are excellent materials. Hastelloy C which contains chromium may even be used for hydrochloric acid solutions which contain the chlorides of iron or copper. The approximate compositions of these and other alloys are given in Table 1. The corrosion resistance of some of these alloys is indicated on the Progress in Metals page of December 22, 1938, page 39, of The Oil and Gas Journal. Data on Worthite (Worthite News of Worthington Pump & Machinery Co., July 1945) at two temperatures are given in Fig. 1.

Such alloys are used widely for valves, fittings, lines, small vessels, pumps, small machinery, circulation

TABLE 1—APPROXIMATE COMPOSITION AND RESISTANCE OF ALLOYS AND MATERIALS FOR HYDROCHLORIC ACID, BRINES OR WATERS

	Percentages													Resistance		
	Fe	Si	Mo	Ni	Cr	Cu	W	Zn	Sn	Mn	Ta	Ag	Others	Hot concentrated	Dilute and cold	Brines or very dilute
Tantalum, metal	...	...	...	...	...	...	...	...	...	...	100	...	...	good	good	good
Silver, pure	...	...	...	...	...	...	...	...	...	...	...	99.9+	...	good	good	good
Glass and ceramics	...	...	...	...	...	...	...	...	...	...	...	...	...	good	good	good
Silicon moly irons (Durichlor)	rest	14+	3+	1	...	...	...	...	...	...	...	...	...	fair	good*	good
Silicon irons	rest	14+	...	...	...	...	...	...	...	...	...	...	...	.....	good	good
Ni alloys with Mo, Cr, Cu, W, Fe, etc. (Hastelloy A and C, Illium, La Bour, Contracid, etc.)	1-20	...	3-20	58-65	14-25	0-8	2-10	...	...	0-2	...	...	...	.....	good	good
Ni, Si alloys, Hastelloy D	...	10	...	85-90	...	3	...	...	...	...	...	...	...	.....	good	good
Fe alloys with Mo, Cr, Ni, etc. (Worthite and Circle L34)	37-48	0-3.5	3-3.5	24-30	19-20	0-5	...	...	...	...	...	...	...	.....	good	good
Nickel, pure	...	...	...	99.9	...	...	...	...	...	...	...	...	...	.....	good	good
Cupro-nickels	...	...	...	70-80	...	20-30	...	...	...	...	...	...	...	.....	fair	good
Nickel silvers	...	...	...	18	...	60-64	...	18-32	...	...	...	...	...	.....	fair	good
Monel metal	...	...	...	25	...	65	...	...	...	...	...	...	5	.....	fair	good
25-12 stainless steel	rest	...	...	12	25	...	...	...	...	...	...	...	...	.....	fair	good
Nickel Resist cast iron	rest	...	...	12-15	...	5-7	...	...	...	1-1.5	...	...	†3	.....	fair	good
Admiralty metal (also aluminum, phosphor and silicon bronzes)	...	...	...	...	...	70	...	29	1	...	...	...	...	.....	fair	good
Red brass (also Muntz metal and copper)	...	...	...	...	...	85	...	15	...	...	...	...	...	.....	.....	fair

*Hot dilute (15 per cent.) †Total carbon.

systems for descaling the tubes of locomotives, exchangers and condensers or for cleaning engine-cooling systems.

Cheap materials. — For extremely dilute acid or chloride solutions, salt water, brines, hard water, etc., many of the common copper-base and nickel-base alloys are being used. Among these are aluminum bronze, admiralty metal, red brass, phosphor bronze, silicon bronze, Muntz metal, Cupro-nickel, nickel silvers, Monel metal, 25-12 stainless iron, pure nickel, and pure copper. Such materials are not really resistant to any but the weakest acid solution but their ready availability, relative cheapness, and properties that are known to most workmen make them useful.

Physical and Corrosion-Resistant Properties Of Hastelloy Alloys

WHERE stainless steel, nickel, and various alloys fail to give economical service in corrosive operations, one of the Hastelloy alloys may prove to be adequate. Ranging in price from 3 to 6 times that of other corrosion-resisting materials, these alloys have been shown to be economically adequate in processes involving the Friedel - Crafts reaction. Although ceramics and carbon have excellent resistance to corrosion, the applications of these materials are limited because of their low mechanical properties. Produced in both forged and cast forms, the Hastelloy materials have been used extensively during the war period in many of the isomerization processing units. Used in both forms, the materials went into vessel linings, vessels, valves, pipe fittings, pipe, and similar equipment items. The alloys also show good mechanical properties within the temperature ranges up to 1,500° F. Table 1 gives average values for all four types or grades of the alloy. More complete data over a wider temperature range is expected to be available after the A.S.T.M. holds its June meeting in Buffalo, N. Y.

All types of the Hastelloy alloys are classed as nickel-base materials and were developed for handling severe corrosion problems. Types A and B are recommended for hydrochloric acid and for other reducing acid and reducing corrosive salt services. Alloy C is not as resistant to hydrochloric and chloride salts as A and B but because of its resistance to other acids it is referred to as having all-around corrosion resistance. Containing 10 per cent silicon, alloy D is shown to have good resistance to sulfuric acid, phosphoric acid, and to many acid salts. It is also shown to have adequate resistance to hydrochloric acid at room temperature. Although the material shows good resistance to abrasion and wear, it is not superior to high-silicon iron except for its high tensiles which run into the order 40,000 psi. The material has been modified to give tensiles as high as 70,000 psi. Resistance of the four alloys to various corrosive media is indicated in Table 2.

Filler metal suitable for welding all four grades of the Hastelloy alloys is produced. Welding procedures are similar to those employed for welding the stainless steels and tests of a varied group of weld specimens show that where welds are properly made adequate strength is obtained. Because they are less plastic than other alloys at welding temperatures down or horizontal-position welding is more desirable than vertical or inclined positions.

TABLE 1

Temp. of test (°F.)	Ult. T.S. psi.	Averages* Yield psi.	% Elong. /1 in.	% Red. area
Type A				
Room	78,000	46,100	14.0	24.5
1,000	65,000	.....	24.4	22.3
1,200	61,000	.....	24.0	20.4
1,500	46,500	.....	18.6	15.8
Type B				
Room	83,100	57,800	11.9	13.9
1,000	77,400	.....	15.0	16.4
1,200	65,200	.....	14.7	16.8
1,500	58,500	.....	18.8	18.0
Type C				
Room	81,200	50,800	10.2	12.2
1,000	67,000	.....	12.5	14.9
1,200	62,100	.....	15.5	15.7
1,500	56,700	.....	18.2	15.4
Type D				
Room	35,000 to 45,000 range	.....	...	...

*0.250-in. diameter specimens.

TABLE 2

Corrosive media—	Conc.	Temp.	Types A	B	C	D
$AlCl_3$	all	all	R to 158°	Rp	R to 122°	....
NH_3	all	all	R	R	R	R
NH_4OH	all	all	R	R	R	R
NH_4Cl	all	all	R to 158°	Rp	R to 122°	....
HCl and HNO_3	all	all	NR	NR	R (RT only)	NR
CaCl (ClO)	all	all	NR	NR	R to 105°	NR
Cl_2	all	all	NR	NR	R to 105°	NR
C_2H_5Cl	all	all	R to 158°	Rp	R to 122°	R to 105°
HCl	all	all	R to 158°	Rp	R to 122°	R to 105°
HF*	all	all	R (RT)	R (RT)	Rp	R (RT)
H_2S	all	all	....	....	R	R
Pb	all	molten	NR	NR	NR	NR
HNO_3	all	all	NR	NR	R(40%) to 150°	NR
H_3PO_4	all	all	R	Rp	Rp	R
H_2SO_4	all	all	R(50%) to 158°	R(60%) to 158°	R(50%) to 158°	R

R—Recommended. NR—Not recommended. Rp—Recommended and preferred type. RT—Room temperature. *Corrosion more severe in vapor phase than in liquid when partly submerged.

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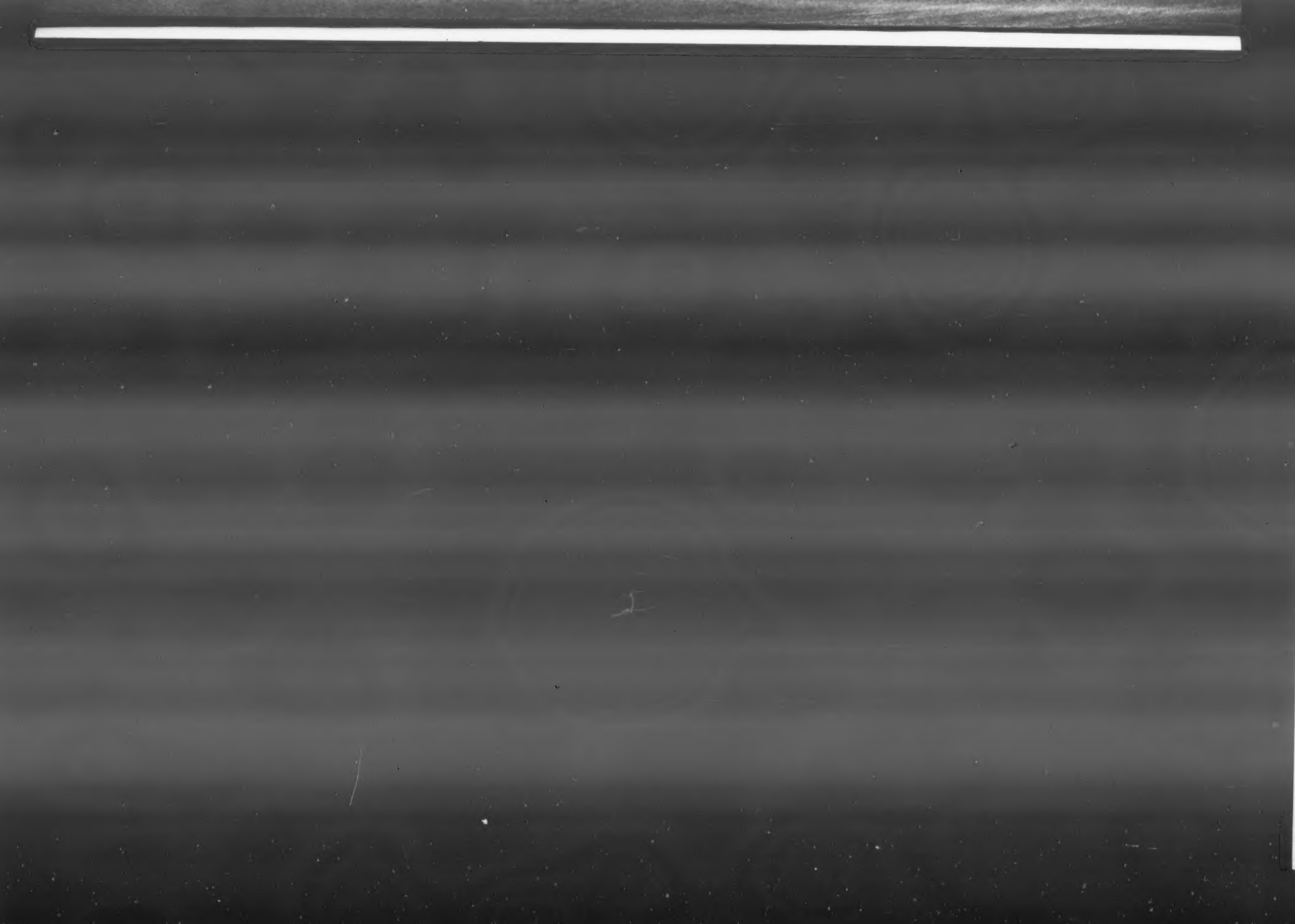

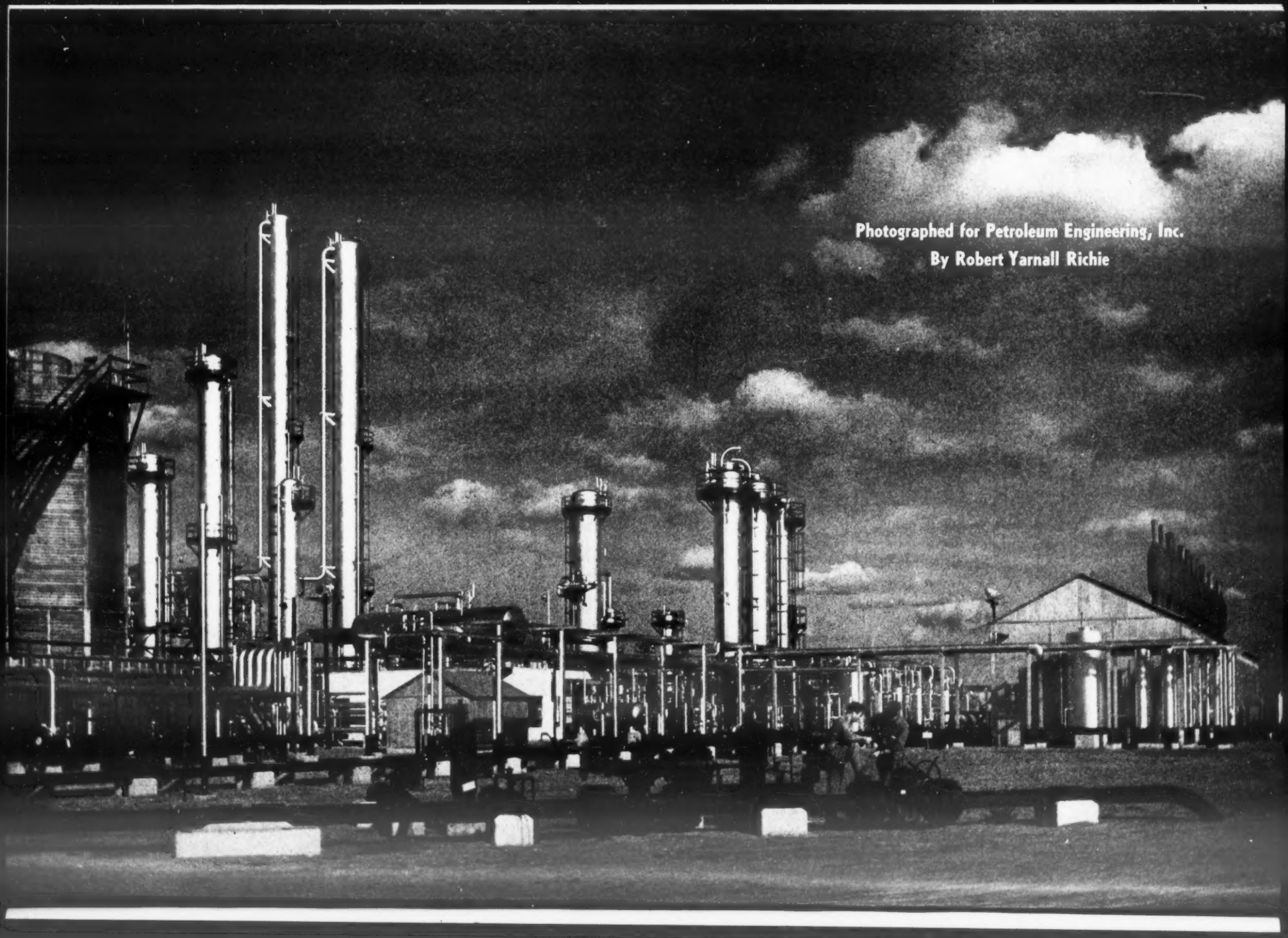

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By Robert Yarnall Richie

ABSTRACTS of A.P.I. PAPERS

Presented at the 1946 Spring Meeting, Pacific Coast Section, Production Division, American Petroleum Institute, Los Angeles, April 11-12

Canal Field Gas Injection Project

R. P. MANGOLD, Exploitation Engineer, Shell Oil Co., Inc., Bakersfield, Calif.

GAS injection was undertaken in the Canal field in hope that ultimate recovery could be increased and the over-all expenditures decreased. Full-scale injection has been in progress for 3½ years during which the average observed reservoir pressure apparently was maintained practically constant until recently. About 75 per cent of the producing wells are now subject, in varying degrees, to the blow-through of injected gas. It is still too early to determine the effect of gas injection on ultimate recovery. There is some indication of a better sustenance of production from upstructure wells than might otherwise have been expected but, on the other hand, there appears to be little, if any, movement of oil to downstructure wells, practically all of which are pumping and have relatively low productivity indices.

Sand in the Canal field is of quite variable permeability, both laterally and vertically, ranging from 10 to 1,000 millidarcys and averaging approximately 200 millidarcys. Average porosity is about 22 per cent, ranging from 15 to 30 per cent and interstitial water content is believed to be about 38 per cent. Original reservoir pressure was 3,550 psi. at the datum plane of 7,800 ft. subsea and the subsurface temperature was 210° F. Large-scale gas injection was started August 1, 1942, and up to January 1, 1946, a total of 13,962,000,000 cu. ft. had been injected.

In order to obtain detailed information on the movement of injected gas through the reservoir, an ethyl mercaptan tracer was injected with the gas. Tentative plans are under consideration for the replacement of conventional liners with blank liners and subsequent perforating of the blank liners to permit testing of selected intervals independent of each other. Tangible benefits observed to date include the return to a flowing status of two formerly pumping and one shut-down well while others appear to be flowing longer than would otherwise be expected. There is some evidence, however, that pressures are not being maintained and that there is a serious blow-through problem that makes it impossible under present conditions to balance input and withdrawals.

Waste-Water Injection in the Stevens Zone—Greeley Field

F. H. SCHNOOR and J. T. CROOKER, Standard Oil Co. of California, Taft, Calif.

THIS paper covers a waste-water problem in the Greeley field in which disposal by injection in a practically depleted oil zone provides means for disposing of the water. At present it appears adjacent upstructure wells have benefited by the artificial water drive caused by injection. A brief production history as related to the waste-water problem is outlined and the equipment used for treating the waste water and the type of injection pumps employed are also discussed. Pressure volume characteristics of the injection wells were illustrated and some comparative cost data on waste water disposal methods were included. Results indicate disposal of waste water by injection compares favorably with other methods but, due to the limited period of injection, the conclusions presented are preliminary.

The Greeley field was discovered in December 1936, and evidence of active edge-water encroachment was present as early as June 1938, at which time edge wells began increasing rapidly in water production. Water movement progressed rapidly up structure and by October 1939, nearly all wells in the main sand, including the highest wells on the structure, had been overtaken. Attempts to exclude this incoming water by selective plugging were unsuccessful. Full-time injection was started in February 1944, and in March of the same year a well one location south increased production from 150 to 220 bbl. per day. As injection continued the production of this well increased to 300 bbl. daily but when injection was temporarily discontinued for mechanical reasons the well's production dropped back to 150 bbl. per day. Upon resumption of injection of waste water, production went back again to 300 bbl. daily. Disposal cost for the temporary plant at Greeley which has disposed of over 1,500,000 bbl. of water during a 2-year period approximates 3 cents per barrel.

Performance of the Playa Del Rey Gas Storage Reservoir

L. S. KELSEY and E. C. BABSON, Union Oil Co., Dominguez, Calif.

DURING the early part of 1942, it was recognized that the expansion of industry in Los Angeles area was likely to overtax the ability of public utilities to furnish gas during the winter months. While some surplus gas was expected during the summer, production from Los Angeles Basin could not be increased sufficiently to meet peak demands during the winter and it was apparently not feasible to construct additional pipe-line or compressor facilities to deliver gas from the San Joaquin Valley because of wartime restrictions on the use of materials. The only apparent solution to the problem was to provide storage capacity so that surplus gas could be stored during the summer and withdrawn during periods of peak demand.

Since construction of surface storage of the required capacity was entirely impracticable, it was concluded that it would be necessary to store gas underground. After considerable investigation, it was concluded that the Playa Del Rey area offered the greatest promise as an underground-storage reservoir. It was not feasible to obtain the required properties in the field by direct purchase so the properties were condemned and taken over by Defense Plant Corp. on September 29, 1942.

Large-scale storage operations were started in June 1943, after an experimental unit had shown the operation was feasible. Injection rates have been maintained at 11,000,000 to 15,000,000 cu. ft. daily except at the beginning and end of the injection period when lower rates have been used. In 1945, it was necessary to resort to the use of solvents to disintegrate the bituminous material which had accumulated during the withdrawal period and this procedure is now standard practice. While it can be seen from the description of operations in this project that certain difficulties have been encountered during the operation and that performance is not theoretically perfect, it is true that 2,330,000,000 cu. ft. of gas have been stored and withdrawn at high pressure during the winter months, thus furnishing an urgently needed supplementary supply to meet peak demands in the Los Angeles area. The project has apparently been of sufficient value to justify a material expansion of facilities during the last fall in an effort to increase the maximum withdrawal rate.

Trends of Drilling Costs In California

RALPH MARSHALL, Drilling & Exploration Co., Los Angeles.

THE author has presented in graphic form data now available on the trends in drilling costs in California. The data show that the over-all daily operating cost of running a drilling rig, regardless of depth, has almost doubled between 1936 and 1945. The data also show that the number of actual drilling days, exclusive of days spent in completion work, has decreased about 50 per cent. With an approximate 100 per cent increase in daily costs and a 50 per cent decrease in drilling days, the average actual cost of making hole was about the same in 1945 as it was in 1936.

During this same period the number of total operating days, including completion, have only decreased approximately 35 per cent. This reduction in total days has not been sufficient to offset the increased operating cost and, as a result, the total over-all operating cost has increased some 25 per cent. Most of the factors contributing to the increased operating costs discussed in this paper are largely beyond control. It becomes obvious that the chief problem is that a further reduction must be made in the time spent in the various drilling operations from rigging up through final completion.

A further study should be made along certain lines, especially (1) a wider interchange of information regarding improved drilling practice; (2) further cooperation between manufacturers and operators in the development and application of more efficient drilling equipment; (3) a study of improved means of maintenance of drilling tools and equipment; (4) that the results of these studies be made more available to the entire industry.

Review of Reservoir Performance—North Coles Levee Pressure-Maintenance Project

W. J. TRAVERS, Richfield Oil Corp., Los Angeles.

THE author points out that the North Coles Levee field is 18,500 ft. long and 9,000 ft. wide, was discovered by seismograph survey, and produces from the Stevens sand of Miocene age located from 200 ft. to 400 ft. below the chert zone. The Stevens sand has a maximum thickness of 850 ft. and consists of 70 per cent sand. The initial gas-oil ratio in the first well was 6,000 cu. ft. of gas per barrel due to the fact the first well included 160 ft. of the gas cap in the producing interval. The second well showed a gas-oil ratio of 7,400 cu. ft. per barrel and the third well showed a gas-oil ratio of 800 cu. ft. per barrel. The third completion was finished below the gas cap area which occupied about 300 acres or 15 per cent of the area.

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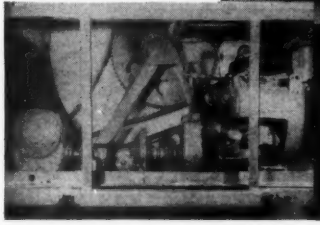

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millidarcys and average about 100 md. Drilling time is about 60 days, divided into 20 days for drilling 8,000 ft.; 20 days drilling through the chert zone which is very hard, and 20 days running casing, cementing, testing, drilling into the oil sand, running liner, and completing. Average costs approximate $100,000.

There are three productive members in the Stevens sand interval. The 21-1 zone is located on the east plunge and north flank and has 21 producing wells completed to date. The 25-33 zone is located on the south flank and four wells have been completed in this sand to date. The 21-1 zone and the 25-33 zone are designated as the upper Western sand. The lower Western sand in which 68 wells have been finished to date is the main source of production and consequently is undergoing pressure maintenance.

The injection rate has varied from 20,000,000 to 35,000,000 cu. ft. at 3,200-3,400 psi. Initial injection started November 19, 1942, and there are now five injection wells. The results to date are encouraging and while the gas cap is expanding there has been no discernible movement of bottom water. Gas-cap expansion was first noted in February 1941, and was slow at first and increased rapidly after April 1942. Six wells were involved and they were shut in for this reason.

Remedial work was started early in 1943 and consisted of blanking off the gas-cap area and limiting wells to production in the lower 200 ft. of zone. This remedial work on early completions averaged about $19,500 per well, later completions being completed below the gas-cap sand. It is believed the program of gas control in this field will require several years' work but that results should more than justify the effort and cost involved.

Experience With Electrical Eddy Current Rotary Brake

A. E. WOOLEN, Standard Oil Co., Taft, Calif.

THE electric dynamic brake used on a rotary draw works does not employ new electric apparatus or principles. It is the adapting of an electrical principle and machine already in use to a new application. Briefly, the electric eddy current dynamometer has been applied as braking power on a draw works. In adapting any machine to a new use, redesigning is necessary to meet the new conditions of service.

During the war, development work on new types of drilling equipment was slow. Consequently, considerable time has elapsed between the conception of the electric brake idea and its practical application. The first brake was installed on a well in the Coles Levee field in 1940. Test curves on the brake showed it capable of developing a torque of 48,000 ft.-lb. at 50 r.p.m. The use of the brake on this well demonstrated its possibilities and another brake was built.

The second model was received in 1942 and has been used on three 11,000-ft. wells in the Greeley field. The new model brake is mounted in the conventional place on the draw-works base and the brake shaft is coupled directly to the drum shaft of the draw works. It is 32 in. wide, 5 ft. in diameter, and weighs approximately 12,000 lb.

Coils are mounted in a stationary member mounted on the frame of the draw works. When a direct current is passed through these coils a surrounding magnetic field is set up. Rotating members consist of the shaft, spider and drum. The drum of the electric brake is directly in the magnetic field of the coils. Any rotation of the drum cuts the lines of magnetism and induces eddy currents within it.

The electrical resistance of the drum is low; hence at relatively low rotational speeds high eddy currents are induced within it. Resistance of the brake to rotation or its braking effort is proportional to the strength of the brake field and the value of the eddy currents induced in the brake drum. Control of the braking effort is effected by increasing or decreasing the voltage impressed on the brake field and the consequent field strength. Braking heat is absorbed by water circulated through the water space of the rim and out to a cooling tank or radiator where the heat is dissipated.

It is felt that the electric brake furnishes ample braking effort for present loads of drill pipe and casing. Its characteristic of furnishing high torque at low rotating speed is very desirable. It will furnish all of the braking effort required at high drum speeds leaving only the braking at very low speeds to be done by the friction brake. It is believed no major problems exist in adapting this equipment to field use and that future development will be in minor refinements and design.

Outlook for California Oil

R. L. MINCKLER, vice president, General Petroleum Corp., Los Angeles.

THE author has presented a complete survey of what can be expected up through 1950 as to the demand for various specific products, the reasons for such anticipated demand and how it must be met. It is estimated that crude-oil production in 1950 should approximate 690,000 bbl. daily and will be made up of 500,000 bbl. daily from present existing fields, 110,000 bbl. per day from wells drilled in the interim and 80,000 bbl. per day from new discoveries.

The author cautions that crude-oil production will drop below expectations if operators persist in producing in excess of the maximum efficient rate of production. Current rate of production, based on the m.e.r. factor, is 825,000 bbl. daily and there appears to be enough undrilled locations to maintain present rates through 1946 but there may be a distinct shortage of suitable undrilled locations in 1947.

California's actual production in March averaged 855,000 bbl. per day indicating an excess of 30,000 bbl. daily which can be attributed mainly to a few fields. The author expects California to be able to supply future needs but at the end of the survey period, 1950, the margin of surplus may shrink to nothing.

Attention is directed to the fact that no new major fields have been found in California in recent years and there is no reason to believe there will be any material change in future discoveries. The author expects a normal discovery rate during the next few years but anticipates the discovery of fields of secondary importance.

Casing Landing Practice

JOHN P. DeHETRE, field engineer, Youngstown Sheet & Tube Co., Los Angeles.

THE advancement of casing program design technique is pointed out in contrast to a lack of corresponding improvement in landing practice. It is suggested that individual attention be given to each well in a new field until enough information is available to warrant the adoption of a standard procedure. Long oil strings and long intermediate protective strings are presented as being the most hazardous and particular attention is directed to the necessity of keeping their landing weight to a minimum consistent with the other factors involved.

Several common landing methods are discussed, showing their weaknesses under certain conditions. A chart is presented to show a method of determining the depth to the freeze point. Another chart shows a method of evaluating the effect on the load at the landing head of pressure and temperature changes. An example procedure is worked out to show the need of engineering consideration of the landing problem. The conclusion that the landing weight of long strings should be held to a minimum is emphasized by reference to A.P.I. data on biaxial loading which shows a substantial reduction of the resistance of casing to burst and collapse when tensile loads are more than half the yield strength of the pipe.

The author points out that several operators have indicated they intend to install strain gages equipped with recording apparatus on the landing joint of casing so that data can be developed as to the actual variation of the load at the landing head. It is believed that an experiment of this type will bring to light reasons for some of the troubles that have occurred in casing after it has been landed.

There have been many refinements during the past few years in the methods of casing program design. All of these improvements have been aimed at tapering casing strings so that a greater percentage of the pipe that is set in the hole is subjected to the maximum allowable stress. This is especially true of long strings of casing since there are practically no operators today who use less than three kinds of pipe in casing strings longer than 8,000 ft. and they may use as many as five or six different weights and grades. It is questioned whether there has been a corresponding advancement in landing practice technique to match this development in casing program design.

Current Concepts of Secondary Recovery and Their Application To California Reservoirs

N. VAN WINGEN, Richfield Oil Corp., Los Angeles, and NORRIS JOHNSTON, General Petroleum Corp., Los Angeles.

THE purpose of this paper is first to review the literature pertaining to the secondary recovery of oil, second, to suggest experiments which will lead to a more complete understanding of the mechanism of fluid displacement, third, to list past and current California secondary recovery and gas and oil storage projects, and fourth, to discuss future secondary-recovery possibilities for California reservoirs. For this analysis the term secondary recovery has been considered to refer only to fluid injection projects instigated after a reservoir has nearly reached its economic limit by primary recovery methods.

Current theoretical concepts pertaining to secondary-recovery methods of operation are summarized in the text. For the future research, certain types of tests are suggested with special emphasis on experimental conditions to be avoided. Data are presented for past and current secondary recovery or gas or oil-storage operations in 28 California fields, in 9 of which operations are still in progress. On the basis of presently available information, the probability of successful large-scale secondary-recovery projects for California appears to be remote. However, some small-scale projects may prove to be economically attractive.

In spite of the impressive list of conclusions pertaining to the theoretical aspects of secondary recovery operations, the authors admit there are a great many problems remaining to be solved. The lack of a thorough understanding of the various phases of fluid displacement is attributable at this time in part to the fact that numerous experiments which have been performed were conducted under conditions which bear little resemblance to those of the actual reservoirs they were supposed to duplicate. For example, conclusions based upon experimental work performed with high-permeability recompacted loose sands

do not necessarily apply quantitatively to tight consolidated sands.

With few exceptions, the California operator to date has not been secondary-recovery minded, and yet the state's future as a principal oil-producing region is probably closely hinged to the ultimate successful application of this method of operation to existing fields. On the basis of data included in this paper, it appears that, in general, the probability of a successful large-scale secondary-recovery project in California may be relatively remote. There are a number of small pools, however, which appear to offer excellent opportunities because of probable high residual-oil content at shallow depths and a relatively high oil mobility.

Results and Use of Oil-Base Fluids in Drilling and Completing Wells

GLENN V. KERSTEN, production engineer, Western Gulf Oil Co., Bakersfield, Calif.

EVIDENCE is shown indicating an improvement in initial well productivity with the use of oil base fluids. There is adequate evidence that the improvement is of lasting benefit. More records are necessary for additional evidence. Swabbing, scratching, or washing are seldom necessary for well completion when using oil base. The effect of oil base on drilling operations is in general to increase rig time and expense. Precautions are necessary to prevent fires, water contamination and unnecessary fluid losses. Completion problems are multiplied if the program calls for more than a drilled hole with a liner. Cement work on blank sections and squeeze work on gun perforations is not as easy as with water base. The expenses of drilling and completion with oil base are increased over that of water base. Improvements in technique and handling should reduce future costs.

Oil or oil-base fluids have been in use for many years and in numerous fields. At present, oil-base fluid is or has been used in nearly all of the various fields in the state. Depth of hole or temperature conditions offer no problem since suspending agents for weight and viscosity control have been developed to a high degree of efficiency. Water has a detrimental effect on oil-base fluids but can be controlled by the addition of slacked lime. Most operators experience no trouble with up to 10 per cent water content. Losses per hole in use varies from 50 to 150 bbl. with an average around 100 bbl. Precautions outlined should reduce losses.

The fluid may be used a number of times in different holes and assuming a loss of 100 bbl. per hole, and a depreciation of one-eighth per hole of 400 bbl. fluid content, six holes may be completed with 1,000 bbl. of stock oil base. This spreads the cost considerably. Open-hole packer-test work seems to be more positive with oil base than with water base. One company which makes open-hole interval tests as a part of completion practice, has not had a stuck packer which could not be jarred loose easily.

A Statistical Approach to Core Analysis Interpretation

JAN LAW, consultant, Los Angeles, and WILLIAM F. CERINI, Union Oil Co., Compton, Calif.

IT is recognized that oil-stained sands as recovered by coring operations may have been removed from a sand capable of producing oil, or from a sand capable of producing exclusively water. Aggregates of samples removed from either type of sand as existent between individual samples, exhibit a wide variation in oil saturation. The variation in oil saturation is sufficiently great that low oil values, in the oil-sand portions of a cored section, extend well into the range of saturation exhibited in the water sand portions. Conversely, high oil values in the water sand portions of a cored section extend well into the range of saturation exhibited in the oil sand portions.

The range of values encountered may be considered as resultant from the influence of four sets of conditioning factors. They are (1) variation in degree of oil saturation as accumulated; (2) variation in intensity of flushing action during coring; (3) variation in retentive power as derived from variation in rock properties; (4) variation produced by errors, accidental and inherent, in the technique of measurement.

As applied to the zone investigated in conjunction with the core-analysis technique which was employed, the variation in oil saturation, as found in core samples recovered from oil-producing sands, is caused by forces or factors other than the variation in porosity, permeability, and water saturation. If variation in retentive power exists as a more dominant influence than is uncovered in this investigation then either the practice of three sample determinations of saturation, porosity and permeability obscures the influence, or measurements are not being made of rock properties critical to retentive power.

It is the authors' opinion that the greater dispersion of oil saturation in oil sands as compared with the lesser dispersion of oil saturation in water sands, provides by means of measures of dispersion, an additional criteria for core analysis interpretation.

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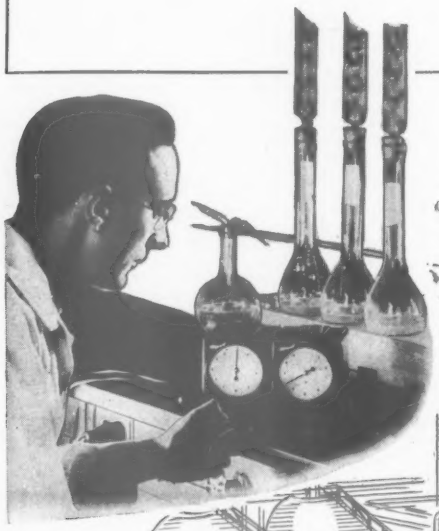

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Fault-Wedge Reservoirs

IN intensely faulted regions faults often intersect, forming barriers where oil and gas may accumulate. Such barriers are double traps and accumulations of petroleum in these traps are termed fault-wedge reservoirs (Fig. 1). These double-trap reservoirs occur in the tops of anticlines and domes and at fault zones

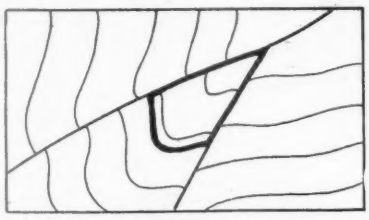

Fig. 1—Fault-wedge reservoir

in monoclinal regions (Fig. 2). In deep-seated and semideep-seated salt domes, fault wedges are common in the intersecting fault patterns and may contain reservoirs which are either separate or part of composite convex trap reservoirs. In other folds, fault wedges can be formed by intersecting reversed faults as illustrated in reservoir 2 of Fig. 2. The Sargent oil field in California is a fault-wedge reservoir at the head of a syncline.

A significant series of reservoirs may be derived from the fault-wedge trap if the role of one of the faults is replaced by other trap-forming factors, namely, differential thickness (reservoir 2, Fig. 3); change in permeability (reservoir 3, Fig. 3); or pinch out (reservoir 4, Fig. 3).

As examples of such double-trap reservoirs may be cited the O'Hern field in Texas, and the reservoir in the Upper Duff zone of the Edison oil field in California.

Double-trap reservoirs can occur on any type of structure. It can probably be shown in many areas condemned for the conventional single-trap reservoirs that untested double traps may still be present. This is particularly worth considering for areas where faulting on a regional scale is observed and where, at the same time, potential reservoir beds show marked tendencies for variation in thickness, permeability, or pinching out.

Combined traps of still higher orders, for example, triple-fault

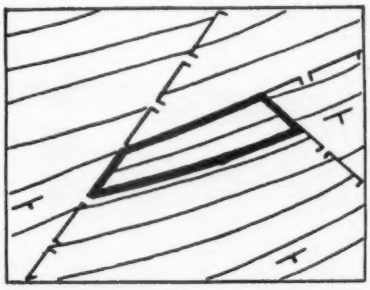

Fig. 4

traps (Fig. 4) are shown to occur in monoclinal regions intersected by regional fault patterns, as in the Luling field, Texas.

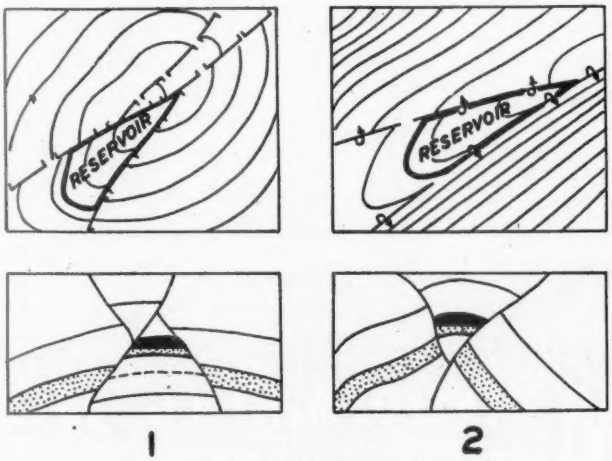

Fig. 2—Fault-trap reservoirs

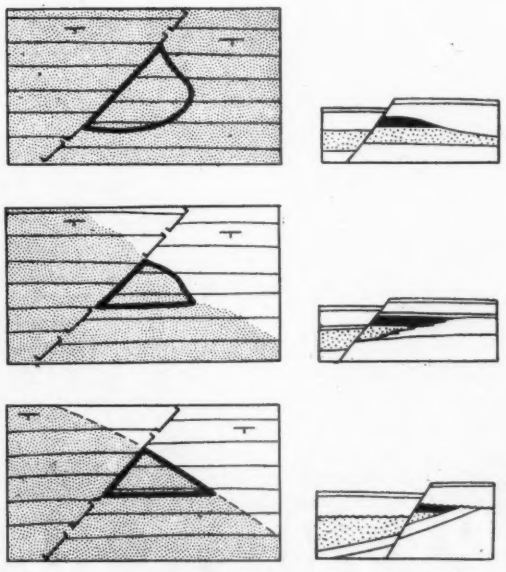

Fig. 3—Double-trap reservoirs

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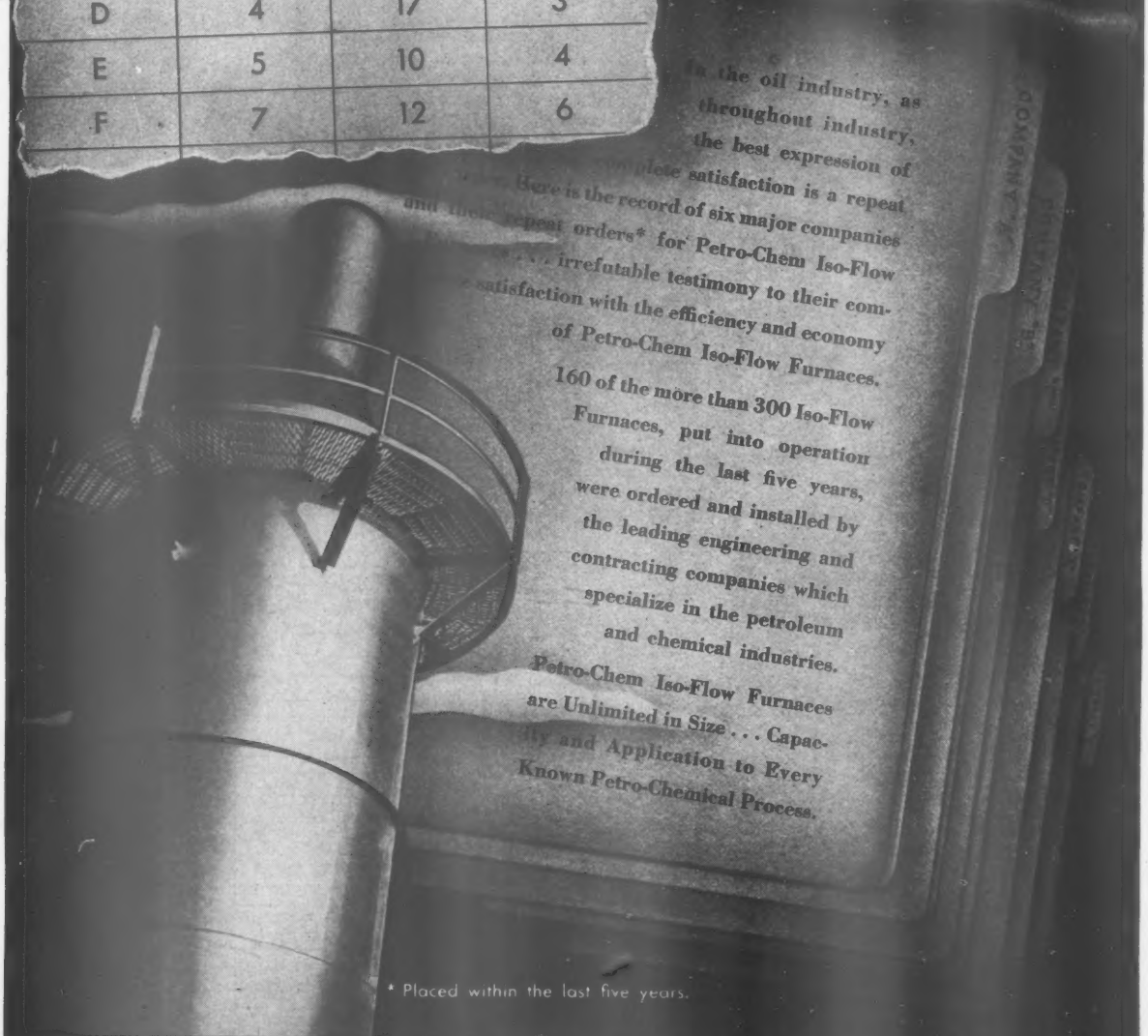
C	8	46	7
D	4	17	3
E	5	10	4
F	7	12	6



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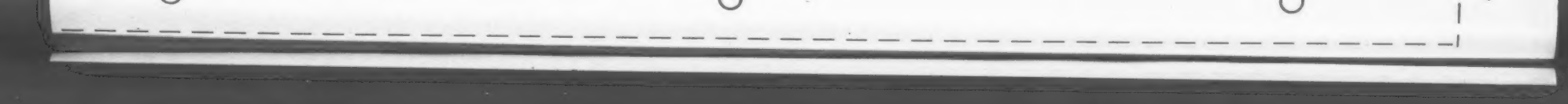


The Refiner's Notebook

A WEEKLY FEATURE OF THE OIL AND GAS JOURNAL

Velocity in Shells of Exchangers

ON the back of this page is a chart (Fig. 1) for estimating the velocity of the fluid through the shell of a single-pass exchanger having conventional half-moon baffles. It is based on an equation of the general form:

$$V = \frac{G}{13{,}000\,D^2} \cdot \left(A + \frac{D}{X}\right)$$

which was derived on the Questions on Technology page of February 2, 1946 (The Oil and Gas Journal, page 62). The meanings of the symbols are:

V = velocity, feet per second.
G = feed, gallons per hour.
D = inside diameter of shell, feet—or more exactly the length of travel across the shell due to baffles.
X = baffle spacing, feet.
A = a constant which depends primarily on velocity.

Constant "A" ranges in values from about 0.5 for very low velocities to about 2.5 for the highest velocities normally employed. Nearly all exchangers are designed for velocities which yield a value of "A" of 1.5 to 2.0.

Example 1.—An exchanger has an 18-in. shell and the baffles are spaced 9 in. apart.

$$\frac{D}{X} = \frac{18}{9} = 2$$

When handling 25,000 gal. per hour (hot fluid) the velocity is found to be 2.8 ft. per second. This was obtained by reading upward from 25,000 on the lower scale to the dotted line marked 2, and reading velocity on the left scale.

Had the feed of 25,000 gal. per hour been measured at 60° F., it would have been necessary to compute the hot volume as indicated in the Refiner's Notebook No. 88 of April 13, 1946 (page 121).

Example 2.—If the shell of the exchanger of Example 1 were 22½ in. rather than 18 in., the value of D/X would be:

$$\frac{D}{X} = \frac{22.5}{9} = 2.5$$

The velocity can be approximated from the curves for an 18-in. shell by utilizing the ratio of the squares of the diameters as follows:

1. The velocity in an 18-in. shell determined as in Example 1, would be 3.5 ft. per second.

2. Ratio of diameters squared:

$$\frac{(18)^2}{(22.5)^2} = \frac{324}{507} = 0.639$$

3. Velocity in 22½-in. shell:

$$0.639 \times 3.5 = 2.2 \text{ ft./sec.}$$

Such a method is not completely accurate because the curves must often be used at or near their ends.

Two Passes Through Shell

Although there are some structural differences in the proportions of single-pass and double-pass exchangers, the chart may be also used for estimating velocities in double-pass exchangers. Primary among the differences in construction is the height of the baffle. The use of larger baffle heights in double-pass exchangers would tend to increase the length of travel of the fluid and its velocity to more than double the velocity in a single-pass exchanger. In contradiction to this, leakage tends to occur across the longitudinal baffle of double-pass exchangers and this tends to reduce the length of travel or velocity. These effects tend to counterbalance one another so that for:

2 shell passes — use double velocity
3 shell passes — use triple velocity
n shell passes — use n times velocity

There is some doubt that the above is satisfactory for a large number of passes but for the common two-pass arrangement the results are reasonably accurate.

In multipass exchangers great care must be used in deciding upon a value for D.

Example 3.—An 18-in. diameter exchanger with baffles spaced at 9 in. (just as in Example 1) handles 25,000 gal. per hour. The approximate velocity for different numbers of longitudinal shell passes will be:

1 pass — 2.8 ft./sec. (Ex. 1)
2 passes — 5.6 ft./sec.
4 passes — 11.2 ft./sec.

The last velocity is so high that its accuracy is doubtful. A large-diameter exchanger or a larger crossbaffle spacing should be used.

Fig. 1(a) of Notebook No. 84 (March 9, 1946) shows the disk and doughnut type of crossbaffle. All of the discussions heretofore and the basis of the chart shown here, pertain to the conventional half-moon or cut-out type of baffle shown in Fig. 1(b) of Notebook No. 84.

The path of travel through disk and doughnut baffles is much the same as that through cut-out baffles except that distance of crossflow is only about half as much. Thus the D/X term in the equation of flow is only half as important:

$$V = \frac{G}{13{,}000\,D^2} \left(A + \frac{1}{2}\,\frac{D}{X}\right)$$

Thus in using Fig. 1 for ring or disk and doughnut type crossbaffles, only half the computed value of D/X should be used.

Example 4.—The exchanger of Example 1 (18-in. diameter, 9-in. baffle spacing) has ring and disk rather than half-moon baffles. The value of D/X is 2 but this term is only half effective, and hence a value of 1 for D/X would be used. For 25,000 gal. per hour and a D/X of 1 shows for an 18-in. diameter exchanger, a velocity of only 1.65 ft. per second. Note from Example 1 that cut-out baffles gave a velocity of 2.8 ft. per second.

Equivalent Diameter

Most heat-transfer and pressure-drop formulas are based on flow in circular pipes and hence an equivalent diameter for the shell of an exchanger must be adopted. For flow across tubes, the equivalent diame-

No. 89 in a series by W. L. Nelson, professor of petroleum refinery engineering, University of Tulsa

Velocity Through Half-Moon Type Single-pass Exchangers

Reference—The Oil and Gas Journal, page 62, Feb. 2, 1946.

Baffles—Cross - Flow - Half - Moon Type.

Tube Sizes—½" to 1¼" o.d.

Space Between Tubes—¼" to ½".

$$\text{Vel. (ft./sec.)} = \frac{G\,(A + D/X)}{13{,}000\,D^2}$$

G = Gal. per hour
D = Dia. of shell, ft.
X = Baffle spacing, ft.

The Constant "A"
Low. Vel.—0.5-1.0
Regular Vel.—1.0-1.5
High Vel.—1.5-3.0

ter is about equal to the space between tubes. For flow longitudinally along tubes, the equivalent diameter (based on four times the hydraulic radius) is about twice the space between tubes. For conventional tube sizes and spacings the equivalent diameter is 1.8 to 2.3 times the space between tubes. A good average equivalent diameter for both types of flow would be 1.5 times tube clearance but the average would be larger for very close baffle spacing.

	Baffle spacing, inches			
D *Diam. / X Baf. spac.	6-in. Shell	12-in. Shell	18-in. Shell	30-in. Shell
4	1.5	3.0	4.5	9.0
3	2.0	4.0	6.0	12.0
2.5	2.4	4.8	7.2	14.4
2.0	3.0	6.0	9.0	18.0
1.75	3.4	6.8	10.3	20.6
1.50	4.0	8.0	12.0	24.0
1.25	4.8	9.6	14.4	28.8
1.00	6.0	12.0	18.0	36.0
.75	8.0	16.0	24.0	48.0
.50	12.0	24.0	36.0	72.0
.30	20.0	40.0	60.0	120.0
.10	60.0	120.0	180.0	360.0
	6-in.	12-in.	18-in.	30-in.

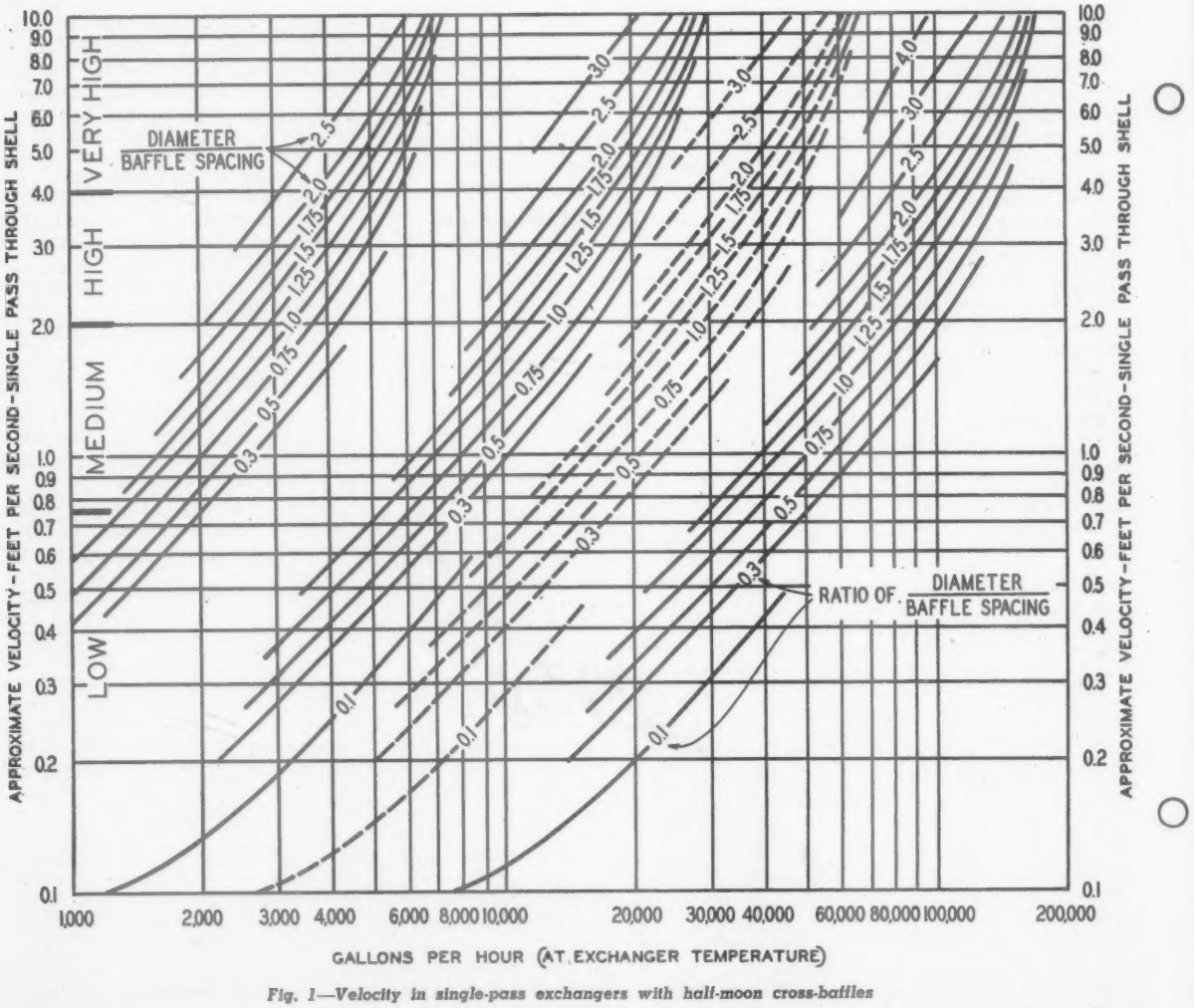
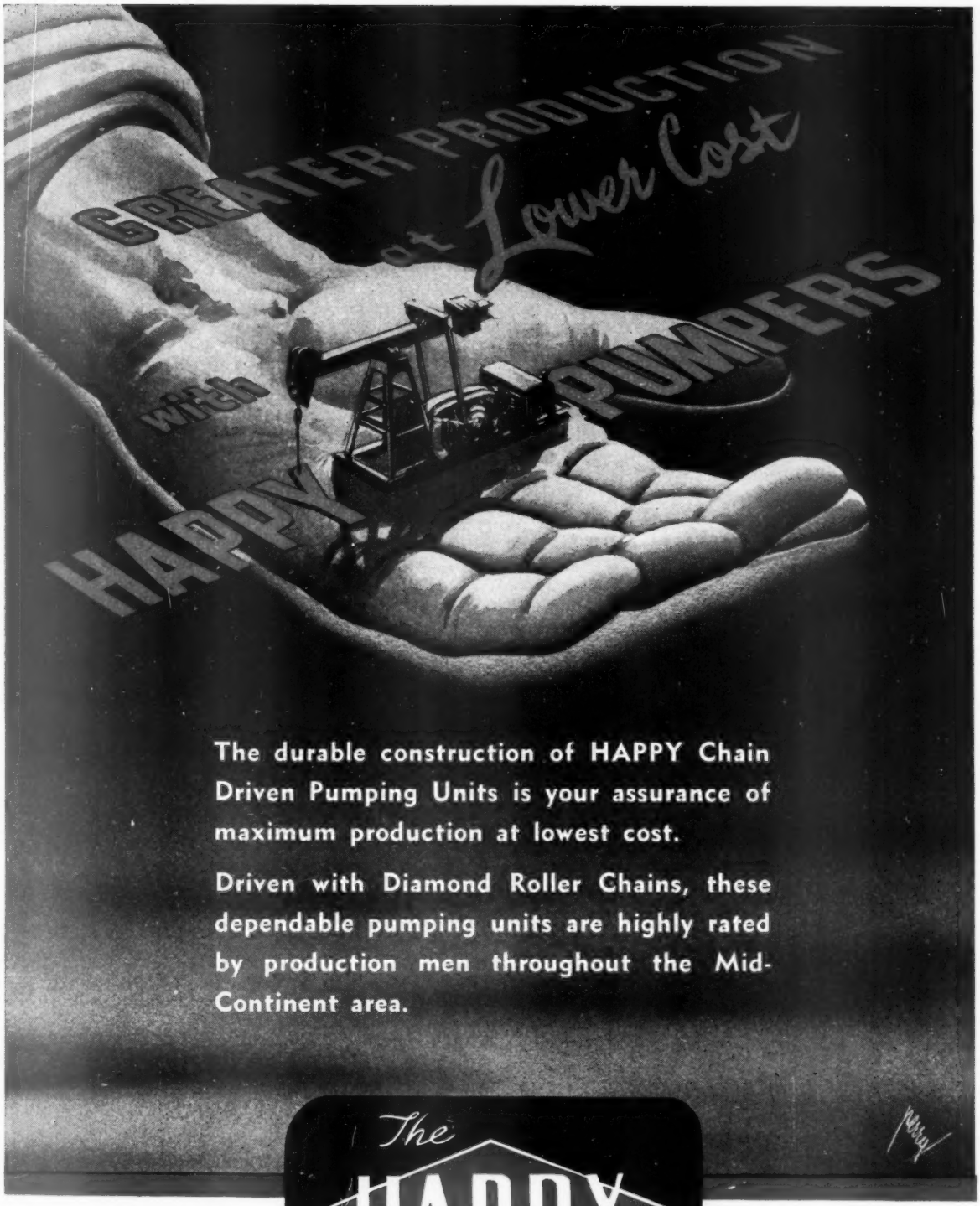


Fig. 1—Velocity in single-pass exchangers with half-moon cross-baffles



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Natural Gas

Needs for Gas Cited in Hearings on Pipe Lines

In Los Angeles and in Washington last week, natural gas transmission companies pressed for approval of large-scale postwar pipe-line projects in testimony before the Federal Power Commission.

A favorable decision, probably around June 1, by the federal commission on the 1,200-mile Texas-Los Angeles natural gas pipe line was forecast as more testimony was taken in Los Angeles on the project.

Among the witnesses appearing in Los Angeles was Robert B. Stewart, staff director, natural gas division of Phillips Petroleum Co., who assured the commission that ample facilities would be provided to move natural gas from Texas fields to the line which will start in Moore County, Texas. Harold W. Wright, general manager, Los Angeles Chamber of Commerce, said a prospective lack of natural gas in California and the growth of West Coast industries make the line indispensable.

William Moeller, vice president of Southern California Gas Co., told the commission California gas producers need not fear consumption of their output will be adversely affected by the line, and Paul Kayser, president of El Paso Natural Gas Co., said the 203,000 tons of steel needed for the Texas-Arizona end would cost about $2,500,000 more because of the recent steel price increase. Fred A. Hough, executive engineer for Southern Counties Gas Co., testified Consolidated Steel Corp. expects to begin fabrication in September on the 214 miles of 30-in. pipe to be used on the California section. A total of 58,000 tons, at a price of more than $6,000,000, will be required.

The line will be the first of any type to span the Continental Divide completely from the Middle West to the West Coast. El Paso Natural Gas plans the section from Moore County to Blythe, Calif. Cost with later additions is estimated at more than $51,000,000 with ultimate delivery of 305,000,000 cu. ft. daily. Southern Counties Gas and Southern California Gas will build the 214-mile section from Blythe westward. Estimated final cost of the West Coast end is more than $15,000,000.

The hearing in Washington concerned the application of Tennessee Gas & Transmission Co. to make improvements and additions to its Texas-West Virginia pipe line at a cost estimated at about $30,000,000. At the hearing, three Kentucky and West Virginia gas company officials among other witnesses asked for approval of the project. L. E. Ingham, vice president of Kentucky Natural Gas Co., testified his company now takes up to 6,000,000 cu. ft. daily and could buy up to 15,000,000 cu. ft. if available from the enlarged line. New facilities requested by Tennessee Gas & Transmission include 410 miles of loop line, three new compressor stations, and 18 new compressor units.

1945 Natural Gas Revenue Shows 2.2 Per Cent Gain

NEW YORK. — Natural-gas revenues during 1945 increased 2.2 per cent over 1944 to reach a total of $691,500,000, according to a report of the American Gas Association.

For the last quarter of 1945, natural-gas revenues totaled $171,600,000, a decrease of 1 per cent which reflected reduced industrial sales and revenues. For the entire gas industry, including mixed and manufactured as well as natural, 1945 revenues were $1,148,000,000 from all classes of sales. This represented an increase of 3.6 per cent over the preceding year when revenues totaled $1,108,200,000. In the last quarter of 1945, revenues for the entire industry amounted to $289,300,000, an increase of 0.6 per cent over the corresponding quarter of 1944.

Approximately 20,200,000 customers were being served by the gas utility industry at the end of 1945. This was an increase of 2 per cent over the total at the end of 1944. Residential customers totaled 19,000,000, a gain of 1.8 per cent; commercial customers gained 5.3 per cent, and industrial customers gained 2.7 per cent.

New Rate Plan Required of Montana-Dakota Utilities

WASHINGTON. —Montana-Dakota Utilities has been directed by the Federal Power Commission to file new rates for the common carrier transportation of natural gas which will reflect a demand change of $13.20 per 1,000 cu. ft. per year and a commodity charge of 7 cents per 1,000 cu. ft.

The lengthy order in the case followed an investigation which was undertaken after a complaint by Mondakota Development Co., which later became Mondakota Gas Co., that Montana-Dakota's rates were unreasonable and discriminatory. Montana-Dakota's common carrier pipe-line system was described as the only outlet for production from two gas wells owned by Mondakota in the Baker-Glendive field in Montana.

Natural Gasoline

High Value of Injected Gas Told to California Group

LOS ANGELES.—The production of reservoirs under primary-pressure control offers opportunities for an increase in profits and ultimate recovery and is a challenge to the industry to reach agreements which will make such operation possible.

This was the main point in a discussion of "The Investment Value of Injected Gas" by M. L. Arnold, Richfield Oil Co. engineer, before members of the California Natural Gasoline Association at a recent meeting.

Arnold presented data indicating the greatest financial return in the exploitation of an oil reserve comes from deferring the sale of gas until most of the oil has been recovered. Among means suggested for obtaining additional gas for injection projects were purchase from gas companies, participation in long-term gas storage projects, development of dry natural gas reserves, and use of fuels other than natural gas in the development and operation of oil-producing properties. The natural-gasoline group also was told their operations might profitably be expanded to include processes producing large quantities of fixed gases as byproducts. Processes involving the thermal cracking of light hydrocarbons were termed the most promising.

Oklahoma Fire Marshal Prepares LPG Rules

OKLAHOMA CITY.—A booklet detailing regulations set up by T. J. Ellis, Oklahoma fire marshal, for the storage and handling of liquefied petroleum gases is now ready for distribution to the industry.

A meeting will be held at the Capitol here in the next few weeks, Ellis said, to discuss with industry representatives LPG system and appliance installation and handling of the gas. More than 700 LPG dealers and installation men have applied for licenses as provided in the Oklahoma law which became effective last September.

PIPE LINES

House Committee Hearings Due on Big-Inch Disposal

WASHINGTON.—Hearings on the Surplus Property Administration's recommendations on disposal of the big-inch pipe lines will be held by the House committee on Expenditures within the next few weeks.

Announcing the hearings, Rep. Carter Manasco of Alabama said SPA's recommendations had not become the policy of Congress. The agency urged that the lines be disposed of for oil transport with natural gas use as second choice. Dissatisfaction with the recommendations has been expressed by various industry groups.

Palestine Gives Tax-Free Concession for Pipe Line

JERUSALEM. — An arrangement under which Trans-Arabian Pipe Line Co. will move oil through Palestine without payment of property or income taxes has been disclosed here by Government officials.

The announcement followed moves by Egyptian Government officials directed toward obtaining for that country the terminus of Trans-Arabian's proposed pipe line from Saudi Arabia.

The Palestine contract with Trans-Arabian granted the company a pipe line concession to an unspecified Palestine port. The agreement was signed January 7.

In Cairo, the Egyptian Department of Commerce earlier was reported to have recommended to the Cabinet that Government make representations to the United States and Saudi Arabia that the line terminate at an Egyptian port. It recommended granting of facilities not only for the line but for refinery erection and residence of technicians.

A subsequent report pointed out that the question of an Egyptian terminus is a matter between the Egyptian Government and Trans-Arabian. The Saudi Arabian agreement with the company provides it may lay the line where it wishes, and the United States Government was described as having no direct interest since the wartime proposal for a United States Government pipe line was abandoned.

At one time, oil companies rejected the possibility of an Egyptian terminus because of likely heavy taxes, according to sources in New York. Trans-Arabian Pipe Line is a subsidiary of Arabian-American Oil Co., jointly owned by Standard Oil Co. of California and The Texas Co. It holds extensive oil concessions in Saudi Arabia.

Cities Service Gas Plans Hugoton-Kansas City Line

KANSAS CITY.—A $25,000,000 natural gas pipe line will be built by Cities Service Gas Co. from the Hugoton field in western Kansas to Kansas City beginning in the spring of 1947, according to a company announcement here.

The 405-mile, 26-in. line will be the largest project ever undertaken by the company, said S. B. Irelan, president. Completion is due in October 1947, under present plans.

Authority for a similar project was sought by Mid-Continent Gas Transmission Co. in an application filed

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with the Federal Power Commission in February. Mid-Continent Gas Transmission plans a 400-mile, 26-in. trunk from near Liberal, Kans., to Kansas City at an estimated cost of $25,620,000.

Griffis Is New Partner in Holland Construction Co.

G. G. Griffis, formerly director of the Canol project in Alaska, has joined H. T. Holland, Jr., as a partner in Holland Construction Co. in Tulsa.

G. G. GRIFFIS

H. T. HOLLAND, JR.

Griffis has spent 25 years in pipeline construction, working principally in South America and Alaska. Holland, president of the company, also announced the firm has recently acquired a large amount of heavy machinery and equipment to enable the company to extend its activities.

Government Sells Burma, India Lines for Scrap

WASHINGTON.—The Government realized about 4.5 per cent of the original cost of more than $31,500,000 by selling military pipe lines in the India-Burma theater as scrap.

In a report on the sales, the office of the foreign liquidation commissioner said the carriers were sold for scrap for about $1,376,000. The lines were described as "adjuncts to the abandoned Stillwell road and the military operations in Burma." A dispatch from India in January said the 900-mile Army pipe line from Assam, India, to Wanting, China, including 35 pumping stations, had been sold to an Indian firm for $105,000.

Personnel Named to A.P.I. Pipe-Line Subcommittees

WASHINGTON. — Committee appointments in the central pipe line transportation committee of the American Petroleum Institute's division of transportation have been announced by C. H. Kountz, Sinclair Refining Co., chairman of the central committee.

Chairmen of the various subcommittees are: H. H. Anderson, Shell Pipe Line Co., topical committee on pipe-line technology; A. H. Riney, Phillips Petroleum Co., subcommittee on internal corrosion of gasoline pipe lines; L. S. Wrightsman, Humble Pipe Line Co., subcommittee for joint A.S.M.E.-A.P.I. volumeter research; L. F. Scherer, Texas Pipe Line Co., subcommittee on cathodic protection; Fayette B. Dow, general counsel, National Petroleum Association, conference subcommittee on accounting regulations; D. S. Bushnell, Northern Group of Pipe Lines, committee on valuation of pipe lines; C. M. Rosebrugh, Gulf Refining Co., engineers-accountants valuation subcommittee.

Pipe Line Plans Approved

WASHINGTON.—Kansas-Nebraska Natural Gas Co.'s application to construct and operate additional natural gas transmission facilities in Kansas and Nebraska has been approved by the Federal Power Commission. The $1,575,000 program, which will enable the company to obtain gas in adequate volume from the Hugoton field, includes laying of 56 miles of 16-in. and 21 miles of 12¾-in. line and construction of eight lateral lines to serve a number of Nebraska communities.

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REFINING

Shortage of Road Oil Emphasized in Report

WASHINGTON. — An acute shortage of road oil stemming from heavy residual fuel oil demands and widespread postwar road improvement programs is borne out by figures compiled by the Bureau of Mines.

Production dropped from 123,000 bbl. in January 1945 to 98,000 bbl. in December 1945, and to 38,000 bbl. in January 1946. Concurrent with this marked decline in production was an increase in domestic demand from 75,000 in January 1945 to 104,000 bbl. in January 1946.

The ratio of demand to supply in January was about 3 to 1. Stocks dropped from 370,000 bbl. in December to 304,000 bbl. in January. In January 1945 they stood at 237,000 bbl.

Refiners in the Mid-Continent area are reporting the shortage at the present time is such that they are unable to meet requirements in many cases.

Continental Modifying Texas Plant in $250,000 Program

WICHITA FALLS, Tex.—A $250,000 expansion program and modernization program designed to increase crude charging capacity from 5,000 to 6,000 bbl. daily is under way at Continental Oil Co.'s refinery here.

Upon completion, the refinery will be further converted to the production of high octane gasoline, according to an announcement. Besides its present crude capacity, Continental's plant has a 2,600-bbl. daily cracking capacity, including polymerization, and 700-bbl. daily capacity for production of alkylate.

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Government Disposes of Three Refining Plants

WASHINGTON. — Three warbuilt Government refining properties have been sold or leased to private interests, according to the War Assets Administration.

Catalyst for the production of high-octane gasoline will continue to be manufactured by American Cyanamid & Chemical Corp. which has negotiated a 2-year lease on the Fort Worth plant it operated during the war. Some experimental work will be done. Another 2-year lease has been taken on the Bakersfield, Calif., plant by Standard Oil Co. of California. Operated during the war by Mohawk Petroleum Corp., this plant will be used in the experimental production of chemicals. In Houston, Eastern States Petroleum Co. bought from the Government for $137,576 part of the plant it operated during the war for the production of aviation gasoline. The transactions are subject to approval of the Attorney General.

Gulf Coast Gasoline Stocks Reported at 1,897,730 Bbl.

HOUSTON.—Stocks of all grades of gasoline and naphthas in plants of Gulf Coast Refiners Association stood at 1,897,730 bbl. at the end of March, according to the semimonthly report of the organization.

The report said current comparisons of refining data were inaccurate on account of the inclusion of new inventories not heretofore reported. Crude runs to stills in the association's plants totaled 158,000 bbl. daily—70.5 per cent of rated operating capacity —but it was pointed out an increase of more than 30,000 bbl. daily in this figure was caused by the inclusion of the capacity of the refinery of the Eastern States Petroleum Co. which recently joined the organization.

Refining Industry Sales Highest in SEC Report

PHILADELPHIA. — Sales volume of the oil refining group topped all other industrial classifications in 9 months of 1945, according to data as-

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sembled by the Securities and Exchange Commission.

After a study of figures of 198 corporations in 17 industry groups, the commission listed sales of 11 companies in the oil industry at $3,978,543,000. Next high was the iron and steel industry. Sales of all the corporations totaled $19,124,375,000. War contract sales of the oil companies made up $1,089,373,000 of the total, or about 27 per cent.

Grease Test Detailed

BUFFALO, N. Y.—"The Norma-Hoffman Oxidation Test for Lubricating Greases—Significance of Test and Recommended Test Procedure"—is the title of Technical Bulletin No. 6 published by the cooperative committee of the Annular Bearing Engineers and the National Lubricating Grease Institute. The new publication amplifies information contained in Bulletin No. 4 and may be obtained from the institute at 164 Chandler St., Buffalo 7, N. Y.

Lanz Appointed Imperial's Assistant Refineries Head

F. C. Lanz, former manager of St. Clair Processing Corp., Ltd., and associated with Imperial Oil Ltd., since 1922, has become assistant general manager of refineries for Imperial.

His appointment was one of several made recently in Imperial's refinery organization. Others are: A. C. Harrop, former superintendent of the Sarnia, Ont., refinery, made general superintendent of the Montreal, Que., refinery; Dr. J. L. Huggett, former assistant manager of St. Clair Processing, made superintendent of the Sarnia refinery; Charles Scrymgeour, former superintendent of the Halifax, N. S., refinery, made superintendent of the Montreal refinery; and R. D. King, who returned to Imperial after military service, made superintendent of the Halifax refinery.

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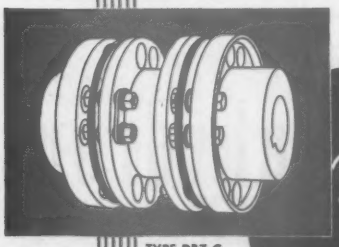
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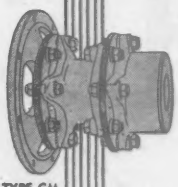
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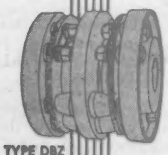
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Sulfur Removal Patent Held Invalid in Appeals Court

PHILADELPHIA. — A patent held by Standard Oil Co. of California on a process for removing sulfur from gasoline has been held invalid in the United States Circuit Court of Appeals here.

California Standard had appealed from a decision of the United States District Court of Delaware in its suit against Tide Water Associated Oil Co. for an injunction and damages for alleged infringement of the patent.

W.P.R.A. to Resume Statistics

The Western Petroleum Refiners Association's monthly statistical summary which was discontinued during the war will be resumed in the near future, according to John C. Day, association secretary-manager. Material covering stocks, production, and other operations, both foreign and domestic, for 1945 and the first few months of 1946 probably will be ready for mailing late in April. Monthly summaries will be furnished thereafter for posting with comparative data in the original book.

Acid Plant for Sale

WASHINGTON. — A sulfuric acid plant at Front Royal, Va., which during the war produced 180,000 tons a year, has been offered for sale or lease by the War Assets Corp.

German Data Available

WASHINGTON.—Scientific data on German development of synthetic emulsifying agents, wetting agents, detergents, and soap substitutes by the Garden plant at Hoechst, Germany, are contained in a report which is available in photostat from the Office of the Publication Board of the Department of Commerce for $3.

Exploration and Drilling

New Strike Spurs Inner-Basin Play

A SECOND inner-basin discovery for Wyoming seems likely on the basis of drill-stem test results. The key well this time, Mountain Fuel Supply Co. 1 Unit, NE SW NW 8-16n-112w, is in Uinta County, in the extreme southwest corner of the state, and about 30 miles north of the Utah state line.

This well was drilled to a total depth of 12,894 ft., one of the deepest in the Rocky Mountain region. It topped the Dakota at 12,554 ft., and had a show of gas. A string of 6⅝-in. casing was set at 12,878 ft., and perforated opposite the Dakota at 12,660-66 ft. On a 24-hour drill-stem test, with packer at 12,636 ft., it flowed 12,300,000 cu. ft. of gas and 150 bbl. of 46.5-gravity (corrected) oil or condensate, with a bottom-hole flowing pressure reported at 4,900 psi.

Geologically the well is located in the Bridger basin subdivision of the large Green River basin. It is about midway between the small Spring Valley oil field and the town of Green River, being about 35 miles west and south of the town. The Spring Valley pool is an old, shallow area, discovered in 1900 and credited with about 200,000 bbl. production to date, from sands at depths from 500 to 2,000 ft., geologically classed as a monoclinal unconformity, with the deepest formation tested being probably Bear River of Upper Cretaceous.

The La Barge field lies about 70 miles north and slightly west of the new test. At La Barge, discovered in 1927, something less than 100,000 bbl. had been produced, largely from the Wasatch formation, which is Eocene Tertiary.

Coming so close on the heels of the Pure Oil Co. inner-basin discovery at River Dome, in 18-48n-92w, Washakie County, Wyoming, this test will add considerable momentum to the inner-basin play. (For previous reference to this play, see The Oil and Gas Journal, March 10 and 17, and October 6, 1945, and March 30, 1946).

There seems to be some difference of opinion about whether to classify this as an oil or condensate discovery. While some call it condensate, other geologists and engineers point to the gravity, below 50°, and the bottom-hole flowing pressure, which at 4,900 psi. is very high, although only about normal for depth. Those who claim it is oil argue that with such high flowing pressure, if perforations are a bit too high in the gas cap, the back pressure would tend to reduce the oil flow, and gas up the oil gravity to some extent. If the latter group's contention should be correct, subsequent work may prove the test to be a larger producer of high-gravity oil, but definitely not in the condensate class.

MICHIGAN

New Completion Promises Sherman Field Extension

SAGINAW, Mich.—Hopes for extension of Isabella County's old Sherman field—possibly for a new pool—resulted from one of last week's 13 completions in Michigan oil and gas fields.

Chartiers Oil Co. 1 Diehl flowed 68 bbl. a day. It is a mile northeast of the old Sherman field, discovered about 10 years ago, and 4 miles south of the more recent Coldwater field.

Another wildcat producer brightened prospects in southwestern Michigan as Ford Oil Co. 1 Tolles in Geneva Township, Van Buren County, pumped 168 bbl. in 9 hours after acid treatment.

Four other wildcat completions were dry holes and another, in Saginaw County, appeared to be a failure. Rowmor Corp. suspended drilling at 3,155 ft. on its 1 Bork in Section 3, Fremont Township, after getting a fair show of oil in Dundee at 3,128½ ft. Efforts to plug off the water may be made.

The 13 completions included small producers in Monterey Township, Allegan County, and the thirtieth Horner well in Norwich field, Missaukee County. Also on the list is one of the biggest natural gas wells completed in Michigan, the Michigan Consolidated Gas Co. 7 fee in Mecosta County's Austin gas field, with initial daily potential of 50,000,000 cu. ft.

Spring drilling upturn was evidenced, as 24 new locations were announced. Four are in Bay County, four in Gratiot County where the Arthur Williams Elba gas well spurs hopes for a large gas field; also planned are three more gas tests in Isabella County's Coldwater Township; other locations are two each in Arenac and Mecosta; one each in Barry, Clinton, Ottawa, Jackson, Roscommon, Van Buren, Tuscola, Kent, and Clara.

MICHIGAN WILDCAT PRODUCERS

Isabella County, Sherman Township: Chartiers Oil Co. 1 Marion Diehl, C N½ SW NW 29-15n-6w, flowed 68 bbl., acidized, TD 3,779 ft., plugged back to Traverse limestone at 3,306 ft.

Van Buren County, Geneva Township: Ford Oil Co. 1 Minnie Tolles Estate, SW SE NE 10-1s-16w, pumped 168 bbl. first 9 hours in Traverse limestone, TD 1,112 ft.

MICHIGAN WILDCAT FAILURES

Alcona County, Gustin Township: R. Paul Donahue 1 Manly Burton, NW NW SW 34-26n-8e, dry hole, TD 2,100 ft. (test deepened from 1,990 ft.)

Kent County, Tyrone Township: Byron MacCallum 1 Green, dry hole, TD 2,871 ft. (plugged back to 2,389 ft. for oil show test).

Montmorency County, Avery Township: Mahlon E. Worsley 1 Adolph Brilinski, SW NE NE 17-30n-3e, dry hole, TD 1,665 ft.

Muskegon County, Dalton Township: Jacob Bolema 1 Emil Hein, SE SE NE 32-11n-16w, dry hole, TD 2,015 ft.

CALIFORNIA

Western Gulf's Outpost Cores Paloma Oil Sand

LOS ANGELES.—Western Gulf Oil Co. has cored 80 ft. of Paloma oil sand in 76-1 Los Angeles Athletic Club, an outpost in the southeastern end of the Paloma field, and an early completion is expected. Drilling is continuing beyond 10,480 ft. in order to open up as much oil sand as possible. Completion will add another 120 acres to the field, and Western Gulf will put proved acreage into the unit plan. Western Gulf's 76-1 is located about ½ mile from present limits of the unit plan, and since a completion would prove intervening acreage the net increase may be in excess of 120 acres. Superior Oil Co. has started drilling Paloma wells with oil base mud and then circulating Paloma crude. Superior's latest work along this line was on 58-35 Anderson. The well came in flowing without swabbing. Total drilling time from spud to completion was 57 days, a probable record for 11,562 ft.

Cymric field, which consists of several pools and unconformable subsurface conditions, has been segregated by the Conservation Committee into its several components. The present classification and allowable consists of the Weston pool, 490 bbl. daily; Fitzgerald pool, 250 bbl. daily.; Anderson pool, 490 bbl. daily; the Brunt pool, 2,165 bbl. daily, and the Bolton pool, 75 bbl. daily. Allocation is computed on a base credit, including a depth minimum ranging from 19 to 33 bbl. daily plus a graduation factor of the remaining capacity ranging from .756 to .856. The Fitzgerald area is expected to decline 1 per cent monthly and the other pools, 2 per cent monthly. Faulting and pinch out of sands are important factors in all pools at Cymric, and this has complicated estimates of probable reserves proved by drilling operations. Edison field of Kern County continues active and indications point to higher production.

Of interest in the Jacalitos field of Fresno County is a new outpost by Standard Oil

Co. of California to be drilled in Section 28-21s-15e. This outpost is located west of present production and on the south flank of the Jacalitos anticline. A successful completion at this point would extend the limits of the field. Standard recently drilled an Eocene test at the extreme southeastern end of the field and while three Eocene sands were found they could not be produced. Development at Elk Hills, particularly in the extreme western end of the Hillcrest area, is showing results that exceed expectations. Navy's 44-24-Z in Section 24-30s-22e, will be an early completion. Top of the Stevens was cored at 5,220 ft., and at 5,650 ft. the well was still in the pay. Indications are the Navy Department will negotiate a deal with Standard of California to acquire acreage outside the limits of Naval reserve No. 1. This could be done by placing a value on Standard's holdings and extending the present arrangement until such time as Standard's equity shall have been liquidated.

New locations during the week were higher than completions but this is a temporary condition which reflects 12 new locations by Long Beach Oil Development Co. at Wilmington, four locations by Jergins Oil Co. at Edison, and three new locations by Wood Callahan Oil Co. at Torrance. These locations are for consecutive drilling.

CALIFORNIA WILDCAT FAILURES

Fresno County, Helm: Norris Stamping & Manufacturing Co. 1 Cross, 36-16s-16e, bottomed in barren gray sand, Kreyenhagen 7,963 ft., Domengine 8,557 ft., Hondo shale 8,569 ft., TD 8,729 ft.

Kern County, Dyer Creek: Jergins Oil Co. 48 Dyer Creek, 9-26s-27e, bottomed in barren gray sand, top Olcese 2,195 ft., top McVan 3,142 ft., top Vedder sand 3,199 ft., TD 3,249 ft.

Edison: Edward Gieck 1 Woodworth, 30-31s-30e, bottomed in hard schist, top basal sand 4,787 ft., top weathered schist 4,885 ft., top hard schist 5,006 ft., minor showings logged, TD 5,185 ft.

Yolo County, Dunnigan Hills: Standard 1 Laugenour 15-11n-1w, no oil or gas found, form. test 2,517-37 ft. recovered 2,250 ft. mud and salt water, gun pedf. 2,335-45 ft., 2,364-84 ft. form. test recovered 450 ft. mud, TD 2,800 ft.

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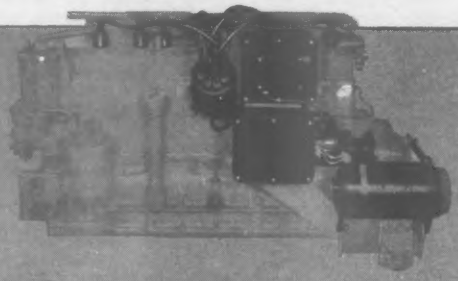

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SOUTHWEST TEXAS

New Gas-Condensate Field Found in Jim Wells County

CORPUS CHRISTI.—A new gas-condensate pool is being opened by Shell Oil Co. 1 Wm. van Hoogenhuyze, wildcat 2 miles east of Wilson field in Jim Wells County. This well flowed an estimated 3,600,000 cu. ft. of gas per day through a 9/64-in. choke plus approximately 8 bbl. of condensate and 190 bbl. of salt water, with tubing pressure 1,600 lb., casing pressure 2,150 lb., through perforations at 9,174-84 ft. Total depth is 10,086 ft., with 4-in. liner at 9,417 ft. On previous test at 9,355-80 ft. the well tested salt water.

Barnsdall Oil Co. 1 Henrichson, new discovery in Dimmit County, 2 miles southeast of Valley Wells, is preparing to reperforate for a production test. The well recovered 150 ft. of gas-cut mud and 1,500 ft. of oil-cut mud on drill-stem test from previous perforations 5,216-26 ft. but due to a poor cement job, operators squeezed off these perforations. Sand with oil odor was logged at 5,214-30 ft. and confirmed in sidewall samples, as well as a gas sand in the Wilcox zone at 3,994-4,043 ft. Total depth is 5,280 ft., with 5-in. casing on bottom.

A new oil field discovery 9 miles southwest of Beeville in Bee County is Bridwell Oil Co. 1 Sliva Estate. Operators are erecting tanks for potential gage. It is estimated to be a 50 to 60 bbl. per day flowing well. Production is through perforations in the Stillwell sand at 4,378-88 ft. Now shut in waiting on tanks with tubing pressure 425 lb., casing pressure 1,100 lb. Total depth is 4,555 ft. with 5½-in. casing at 4,445 ft.

Of the 28 new locations reported this week, 10 are wildcats, 2 each in Bee and Willacy counties, and 1 each in Cameron, Dimmit, Duval, Guadalupe, Karnes, and Webb counties. The 33 completions included 9 dry wildcats, 2 in Starr County, and 1 each in Caldwell, Dimmit, Duval, Lee, Live Oak, Maverick and Milam counties. Refugio County received five new locations while Bee and Nueces each received three. Nueces and Starr counties each received four completions.

SOUTHWEST TEXAS WILDCAT FAILURES

Caldwell County: Ogden B. Klein 1 D. E. Smith, L. D. Sowell Survey, Abst. 266, 7 mi. SE of Lockhart, top of Edwards 2,665 ft., dry, TD 2,674 ft.

Dimmit County: Humble 1 Mogford & Kimble, Trinidad Sanches Survey, Abst. 665, 2 mi. S of Carrizo Springs, dry, TD 3,002 ft.

Duval County: Humble 1 Dallas Jt. Stock Land Bank, Hoffman area, SK&K Survey 503, dry, TD 3,200 ft.

Lee County: Fred Pederson 1 Oscar Brown et al, D. Hudson Survey, 2 mi. S of Tanglewood, dry, TD 8,786 ft.

Live Oak County: John T. Jones et al 1 Pal Maurin, in Stephen Hays Grant, Abst. 10, dry, TD 930 ft.

Maverick County: G. P. Shelton et al 1 Mitchell Heirs, Sec. 84, Survey 54, 6½ mi. N of Eagle Pass, dry, TD 2,080 ft.

Milam County: Burt and McDowell 1 Otto

Galbreth, in J. J. Liendo Survey, 4 mi. E of Thorndale, dry, TD 879 ft.

Starr County: H. H. Howell 1 Francisco P. Margo, in Joaquin Salinas Grant, Porcion 70, 10 mi. NW of Roma, dry, TD 6,286 ft.

T. E. Stephens 2 Zaragosa Salinas, in La Sacatosa Grant, 30 mi. NW of Rio Grande City, dry, TD 1,703 ft.

PERMIAN BASIN

New Well Promises First Hale County Production

MIDLAND.—Stanolind Oil & Gas Co. 1 Lee Irish, Section 18, Block DT, HE&WT Survey, promises the first oil production in Hale County. The test is ½ mile north of the Lubbock County line. On a 1-hour drill-stem test of the Clear Fork section of the Permian lime from 5,800-56 ft., 700 ft. of clean, dark green oil and 60 ft. of oil-cut drilling mud was recovered.

On a later drill-stem test from 5,853-80 ft. recovery was 450 ft. of clean oil and 165 ft. of oil and gas-cut mud. After a 15-minute shutin, pressure was built up to 1,900 lb. Seven-in. casing was scheduled to be run to around 5,690 ft., the oil-bearing zone. The well is 3 miles east of the most eastern production in the Anton pool of Lamb County.

Stanolind 1 Mack Taylor, Section 8, Block B-2, PSL Survey, 1½ miles east of the Keystone-Ellenburger field, Winkler County, has been completed in the Devonian after failing in the Ellenburger. It had a 24-hour flow of 617.12 bbl. of 32-gravity oil through a ¼-in. tubing choke. Gas-oil ratio was 536 to 1. Production is from 8,050-8,135 ft.

Stanolind 1 Grisham-Hunter Corp., Section 10, Block 45, T-2-N, T&P Survey, Devonian discovery on the northwest edge of the Goldsmith (San Andres lime) field in northwestern Ector County, flowed naturally 207 bbl. of 43.2-gravity oil in 10¾ hours. The oil came from open hole between the bottom of a 5½-in. casing cemented at 7,903 ft. and 7,965 ft. Gas-oil ratio was 926 to 1. The well has been shut in for storage. One and one-half miles west and slightly south of this well, Stanolind 1 Williamson, Section 5, Block 45, T-1-N, T&P Survey, is testing the Devonian, topped at 8,045 ft. The well yielded 16⅓ bbl. of oil in 5 hours on the swab.

Argo Oil Corp. 1 Dora Roberts, Section 194, Block 13, H&GN Survey, southeastern Reeves County wildcat which has shown gas and distillate in the lower Permian, 13 miles northeast of Balmorhea, cored from 10,220-231 ft. and recovered 2 ft. of lime with streaks of shale. There were slight gas bubbles and staining in the section. Operator was coring below 10,437 ft.

Humble Oil & Refining Co. 1 Vick, Section 45, Block 5, H&GN Survey, indicating the first oil production in Kent County 2 miles northwest of Polar, has perforated the Ellenburger pay section from 7,775-7,810 ft. Operator was swabbing in an effort to kick off the well.

Humble 1 Pio Crespi, Section 19, Block 38, T-2-S, T&P Survey, 1 mile northwest of the discovery well in the Midland pool, Midland County, ran a 19-minute drill-stem test from 10,347-441 ft. There was a fair blow of air after 17 minutes with no shows in the 2,500-ft. water blanket recovered. It was being deepened.

TXL field, Ector County, Garza field, Garza County, Slaughter field, Cochran and Hockley counties, and Waddell field, Crane County, each had two completions this week. Fullerton field, Andrews County, and TXL-Ellenburger field each had five locations, TXL-Devonian field and Welch field, Dawson County, each had four, and Martin-Ellenburger field, Andrews County,

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three. TXL field has 37 drilling wells; Keystone-Ellenburger, Winkler County, 32; Fullerton field, 27; Block 31 field, Crane County, 20; Welch field, 12; Todd Deep field, Crockett County, 7, and Martin field, 6.

WEST TEXAS SUCCESSFUL WILDCATS

Ector County: New oil pay—Stanolind 3-Q Scharbauer, Sec. 12, Blk. A, PSL Sur., ½ mi. N Goldsmith pool, elev. 3,159 ft., flowed 398 bbl. day through ¼-in. choke on 2-in. tubing, perf. 6,090-6,185 and 6,200-90 ft. Clear Fork, gravity 40°, gas-oil ratio 1,334 to 1, TD 9,155 ft.

Pecos County: New oil pool—Wm. Y. Penn 1 W. T. Shearer, Sec. 41, Blk. 10, H&GN Sur., 4 mi. W Buena Vista, flowed 36 bbl. day through 24/64-in. choke on 2-in. tubing, perf. 1,940-60 Yates, gravity 35.5°, gas-oil ratio 1,994 to 1, TD 1,964 ft.

WEST TEXAS WILDCAT FAILURES

Dawson County: Ralph Lowe 1 L. B. Vaughn, Sec. 39, Blk. 34, T-5-N, T&P Sur., 1 mi. W Spraberry, elev. 2,902 ft., St. Andres 3,650 ft., dry, TD 4,001 ft.

Tom Green County: Harley Sadler 2-80 Bob Mims, Sec. 80, Blk. 6, H&TC Sur., 3 mi. SW Funk pool, elev. 2,319 ft., dry, TD 760 ft.

SOUTHEASTERN NEW MEXICO

HOBBS.—Humble Oil & Refining Co. 1-B Hardison, 34-21s-37e, southeastern Lea County discovery 2 miles east of Eunice, has been completed to flow 624 bbl. in 24 hours through casing perforations from 6,420-80 ft. and 6,500-60 ft. Production is from the Yeso (Holt) zone of the Clear Fork section of the Permian lime.

The well is 1½ miles north of the nearest Yeso producer in the Paddock field and 2½ miles north and slightly west of the nearest well in the Drinkard field where there is also production from the Yeso.

Neville G. Penrose, Inc. 2 Penrose, 9-22s-37e, in the same section with wells in the Paddock field flowing from the Ellenburger, flowed at the rate of 102 bbl. daily from the Holt pay from 5,158-68 ft.

C. T. McLaughlin and Cosden Petroleum Corp. 2 Phillips-State, outpost to the West Roberts field, west of central Lea County, 2-17s-32e, was completed to flow 43 bbl. of oil in 24 hours through perforations from 4,180-4,315 ft. The section had been shot with 130 qt. of nitroglycerin. A 3,500-ft. wildcat will be drilled 2 miles west of the Lynch field in western Lea County. It is Willis et al 2 Flint, 990 ft. from the south line and 2,310 ft. from the west line of 29-20s-34e.

Square Lake field, Eddy County, had two completions this week and Langlie-Mattix, Paddock and West Roberts fields, Lea County, each had one. Square Lake field had four locations, Langlie-Mattix, Maljamar and West Eunice fields, Lea County, each had one. Caprock field, Chaves and Lea counties, has 29 drilling wells; Square Lake field, 10; Grayburg-Jackson field, Eddy County, 9; and Paddock and Drinkard fields, Lea County, each 7.

SOUTHEASTERN NEW MEXICO WILDCAT FAILURE

Roosevelt County: Southern Union Gas 1 Lucas, 5-2n-30e, 20 mi. NW Portales, elev. 4,279 ft., Abo 4,640 ft., Pennsylvanian 5,950 ft., granite 7,146 ft., dry, TD 7,155 ft.

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TEXAS GULF COAST

Hardin County Field Extended Eastward

HOUSTON.—The Saratoga pool of Hardin County has been extended 3,000 ft. to the east by Lenoir M. Josey et al 2 Caswell Trust, in BBB&C Survey, Abstract 311. On a drill-stem test through perforations at 5,852-64 ft., the well flowed at the rate of 120 bbl. of oil daily through ¼-in. and ⅛-in. chokes with 900 lb. flowing pressure. Gravity of the oil is 35°. Total depth is 5,946 ft., with 5½-in. pipe set on bottom. Well is now shut in waiting on tanks.

Sun Oil Co. 1 R. B. Trull, I&GN Survey 7, confirmation test for the Midfields area of Matagorda County, was completed for an open flow potential of 98,000,000 cu. ft. of gas from sand 9,088-9,097 ft. On a ⅛-in. choke the test flowed at the rate of 3,819,000 cu. ft. of gas along with 308 bbl. of condensate with 3,190 lb. pressure on tubing and casing sealed. Gas-oil ratio was 12,400 to 1, and gravity 57°.

A new sand opener, F. M. Corzelius 1 O. P. Hairgrove, in Aldine field, Harris County, on open flow test gaged 80,000,000 cu. ft. of gas with an ungaged amount of condensate through perforations at 7,528-40 ft. On a ⅛-in. choke the well flowed 3,683,000 cu. ft. of gas with 2,480 lb. flowing pressure on the tubing, 2,680 lb. casing pressure, and a shut-in tubing pressure of 2,780 lb. Sand was topped at 7,527 ft., total depth 7,542 ft., with 5½-in. casing cemented to 7,539 ft.

There were 19 new locations this week, 3 wildcats, 2 in Chambers and 1 in Montgomery County. North Thompson field in Fort Bend County received three locations while Danbury in Brazoria County received two. Three new pays were opened in Upper Gulf Coast, one each in Harris, Matagorda, and Wharton counties. Two dry wildcats were completed, one each in Harris and Wharton counties.

UPPER GULF COAST SUCCESSFUL WILDCATS

Harris County: New gas pay in Aldine pool F. M. Corzelius 1 O. P. Hairgrove, in E.

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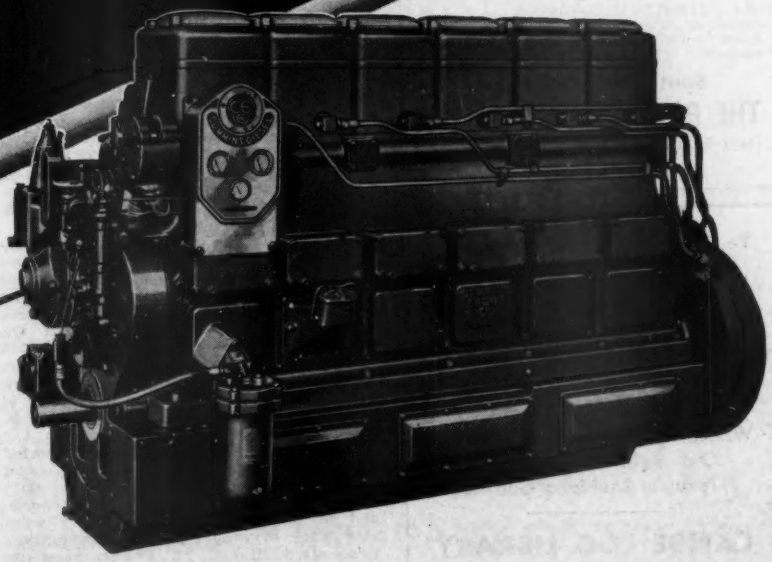

CUMMINS ENGINE COMPANY, INC., COLUMBUS, INDIANA

Farias Survey, Abst. 278, TD 7,542 ft., top sand 7,527 ft., perf. 47 holes from 7,528-40 ft., PT: 3,683,000 cu. ft. gas per day through a ¼-in. choke. Open flow 80,000,000 cu. ft. gas. TP 2,480 lb., CP 2,680 lb., SIP 2,780 lb., gas, no water.

Matagorda County: New gas-condensate pay in Midfields pool—Sun Oil 1 R. B. Trull, in I&GN Survey, Block 6, TD 9,202 ft., top sand 9,088 ft., perf. 36 holes 9,088-97 ft., PT 3,819,000 cu. ft. gas and 308 bbl. condensate per day through a ⅛-in. choke, ratio 12,400 to 1, open flow 98,000,000 cu. ft. gas per day, TP 3,190 lb., gravity 57°, no water.

Wharton County: New oil pay in Lane City field—H. W. Snowden 5-A H. C. Cockburn, S. Castleman Survey, Abst. 12, TD 5,503 ft., top sand 5,345 ft. (Marginulina), perf. 5,345-53 ft. and 5,363-85 ft., with 170 shots, PT 61 bbl. 24 hours through a ⅛-in. choke, gas-oil ratio 260 to 1, TP 340 lb., CP 1,280 lb., gravity 26°, no water.

UPPER GULF COAST WILDCAT FAILURES

Harris County: J. E. Ludeau 1 A. W. Augsburger, Little York area, W. J. Foster Survey, dry, TD 4,135 ft.

Wharton County: Roxoil Drilling Co., Inc. 1 Jesse Bartley, ETRR Survey, 3 mi. S of Hillje townsite, dry, TD 6,605 ft.

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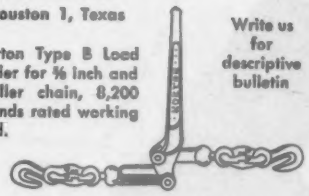

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SOUTH LOUISIANA

Deepest Oil Well Completed In Iberia Parish

NEW ORLEANS.—The deepest oil producer was completed this week in Iberia Parish by the Shell Oil Co., Inc. at its 2 Smith-State Unit 1, Lease 50, 13-14s-5e, on Week's Island. Drilled to a total depth of 14,301 ft., this well was plugged back to 13,820 ft. to complete through perforations at 13,763-78 ft., or approximately 250 ft. deeper than the previous world's record holder, Shell 1 Smith-State, only 400 ft. to the south of the new producer. On initial production this well flowed 530 bbl. of 33°-gravity oil per day through an 11/64-in. choke with a tubing pressure of 2,750 lb., and gas-oil ratio of 1,425 to 1. The Louisiana system of proration will permit this well to produce at the rate of 380 bbl. per day. The 7-in. casing was cemented at 13,340 ft. and 5-in. liner was set and cemented down to a depth of 14,083 ft.

A new upper pay has been found in Continental Oil Co. 1-B Prairie Canal Co., Inc., 3-11s-9w, at East Moss Lake in Calcasieu Parish. Drilled to a depth of 10,490 ft. a new pay was encountered from 9,991-10,031 ft. with sands showing oil from 9,997-10,024 ft. Regular field pay was picked up showing oil from 10,442-474 ft.

Humble 1 Louisiana Delta Farms Co., wildcat test in the Little Temple area of LaFourche Parish, 19-17s-23e, gaged 3 bbl. of oil and 7 bbl. of salt water hourly through a 3/16-in. choke with 492 lb. flowing pressure on the tubing, and a gas-oil ratio of 457 to 1. Oil is 30-gravity, and production is through 32 perforations at 10,622-26 ft. This well is now shut in.

Continental Oil Co. and Sohio Petroleum Co. 1 Cameron Parish School Board, wildcat test in the Johnson's Bayou area of Cameron Parish, 16-15s-14w, is preparing to run production test in sands showing gas and condensate from 7,305-20 ft. On test through 48 perforations from 9,196-9,210 ft. the well flowed salt water. Operators plugged back to make production test. Total depth is 9,302 ft., and 5-in. liner is set between the 7-in. setting at 8,625 ft. and the total depth.

There were 13 new locations reported this week, 2 wildcats, 1 each in Acadia and St. James parishes. Three new pays were opened, one each in Acadia, Cameron and St. Landry parishes, and five wildcats were dry, one each in Assumption, Beauregard, Iberia, St. Charles, and St. Martin parishes. Acadia and Cameron parishes led with two completions each while Assumption, Beauregard, Iberia, Jefferson Davis, LaFourche, Plaquemines, St. Charles, St. Landry, St. Martin and St. Mary each received only one.

SOUTH LOUISIANA SUCCESSFUL WILDCATS

Acadia Parish: New gas-condensate pay in Branch pool—The Union Sulphur Co., Inc. 1 Bruner-Bonin, 60-8s-2e, TD 11,919 ft., top sand 11,808 ft., perf. 53 holes 11,808-821 ft., PT 4,300,000 cu. ft. gas per day and unestimated amount of condensate daily through a 10/64-in. choke, TP 5,000 lb., shut-in TP 6,500 lb., gas, no water.

Cameron Parish: New gas-condensate pay in Mud Lake pool—Magnolia 1-B Lutcher, 33-14s-11w, TD 10,825 ft., top gas sand 9,636 ft. Perf. 48 holes 9,640-50 ft., PT 31 bbl. condensate and 2,983,000 cu. ft. gas per day through a 12/64-in. choke, gas-oil ratio 96,217 to 1, TP 3,400 lb., gravity 48°, no water.

St. Landry Parish: New gas pay in North Cankton pool—Sun Oil Co. 1 L. A. Guidry, 13-8s-3e, TD 10,550 ft., top sand 10,193 ft., perf. 12 holes 10,221-224 ft., PT: Gas, no gage, shut in, TP 3,050 lb., SITP 3,400 lb., no water.

SOUTH LOUISIANA WILDCAT FAILURES

Assumption Parish: Continental 1 Whitecastle Lumber & Shingle Co., Ltd., 28-12s-13e, 1 mile north of Napoleonville production, dry, TD 12,061 ft.

Beauregard Parish: Sun Oil 1 Rice Land Lumber Co., Singer area, 32-4s-11w, dry, TD 10,662 ft.

Iberia Parish: Continental 1 Willie S. Patout Sr., et al, Grand Marais area, 8-13s-7e, dry, TD 12,982 ft.

St. Charles Parish: Union Oil Co. of Calif. 2 Milliken & Farwell, Hahnville area, 74-12s-19e, dry, TD 9,934 ft.

St. Martin Parish: Continental Oil I Marcelite G. Fournet, 6,700 ft. north of St. Martinville production, 113-10s-6e, dry, TD 12,375 ft.

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WICHITA FALLS, TEXAS

N. CENTRAL TEXAS

Young County Wildcat Logs Oil Show in Caddo Lime

WICHITA FALLS.—Walter H. Gant and T. A. Wright 1 L. L. Davidson et al, J. R. Hayes Survey, Abstract 1870, Young County wildcat 5 miles southeast of Graham, logged shows of oil in the Caddo lime from 3,820-40 ft. Slightly oil-cut mud was recovered on a 30-minute drill-stem test of the section. It was drilling below 3,858 ft. in shale. C. W. and W. L. Snoddy 1 Wilson, Block 63, ATNCL Survey, wildcat 6 miles northwest of Scotland in eastern Archer County, topped the Caddo lime at 5,212 ft. and drilled lime with odor and good porosity from 5,212-20 ft. It then drilled dry lime from 5,220-30 ft. A 30-minute drill-stem test was run from 5,208-48 ft., total depth, and after 30 ft. of mud with no shows was recovered, operators were preparing to abandon.

Continental Oil Co. will drill 2-C Heard, 1,320 ft. northeast of the discovery well in the Heard Ellenburger pool of southern Clay County, 3 miles southwest of Buffalo Springs. It is 1,400 ft. from the south and east lines of Block 3,222, TE&L Survey. It is also 2,750 ft. southeast of L. T. Burns 1 Ford, opener of Caddo lime production in the pool. Standard Oil Co. of Texas 1 Mitchell, J. B. McNair Survey, 10,000-ft. wildcat 2 miles north of Sherman in northern Grayson County, was drilling below 7,699 ft. in shale.

Electra field, Wichita County, had five completions this week; Holliday field, Archer County, three, and Sunshine Hill and West fields, Wichita County, each had two. Electra field had 10 locations, Madden field, Wichita County, 3, and Holliday field, 2. Sivells Bend field, Cooke County, has seven drilling wells; Knox field, Young County, and National field, Wilbarger County, each six; Gatewood field, Cooke County; Cooper field, Archer County; Nocona field, Montague County, and Johnson field, Young County, each have five.

NORTH CENTRAL TEXAS WILDCAT FAILURES

Archer County: Young, Timberlake & Kellerher 1 J. M. Powell, Heirs of Rachel Storey Sur. A-373, 1½ mi. E and 2 mi. W Archer City, dry, TD 1,340 ft.

Baylor County: White & Eagle Co. 1 McDonald, Sec. 148, T&NO Sur., 3 mi. S and 1½ mi. E Seymour, dry, TD 3,155 ft.

Jack County: Hanlon-Buchan et al 2-E W. M. Crowley, SPRR Sur. A-579, 4 mi. S and 3 mi. E Antelope, dry, TD 609 ft.

Stephens Pet. Co. 1 Mrs. P. A. Jackson, Sec. 1, WCRR Sur. A-904, 3 mi. N and 2 mi. W Joplin, elev. 1,136 ft., Caddo 4,680 ft., dry, TD 5,253 ft.

Montague County: S. D. Johnson et al 1 Claude Willis, S. Cary Sur. A-1142, 3 mi. N and ½ mi. W Forrestburg, elev. 1,210 ft., Caddo 6,697 ft., Marble Falls 7,210 ft., dry, TD 7,406 ft.

Wichita County: Ted A. Norwood et al 1 J. B. Spradling, Lot 306, Waggoner Colony Lands, 3 mi. NE Electra, dry, TD 1,750 ft.

WEST CENTRAL TEXAS

ABILENE.—After getting no shows on a drill-stem test, Continental Oil Co. 1 Woody, D. A. Deal Survey, Parker County wildcat 1 mile south of Poolville, is considered dry at 6,547 ft. in the Ellenburger. Phillips Petroleum Co. will drill a north offset to its Ellenburger discovery, 1 Pan-Ace, in the Sedgwick pool in Shackelford County. It is 1 Pan-Nellen, 660 ft. from the north line and 606 ft. from the east line of Section 16, Lunatic Asylum Land Survey.

Fulwiler & Hughes Drilling Co. and Allied Oil Co. have staked a 660-ft. west off-

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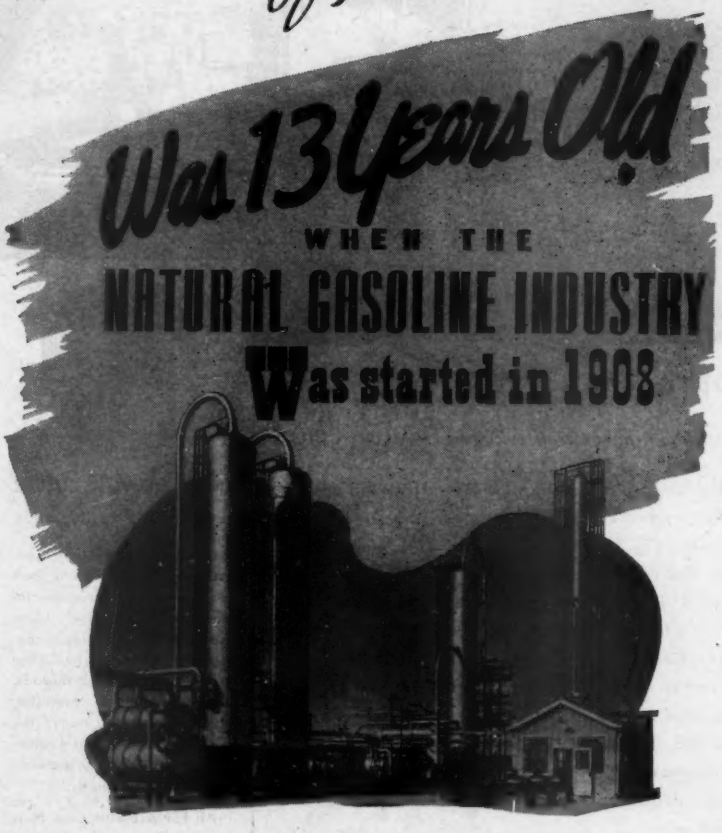

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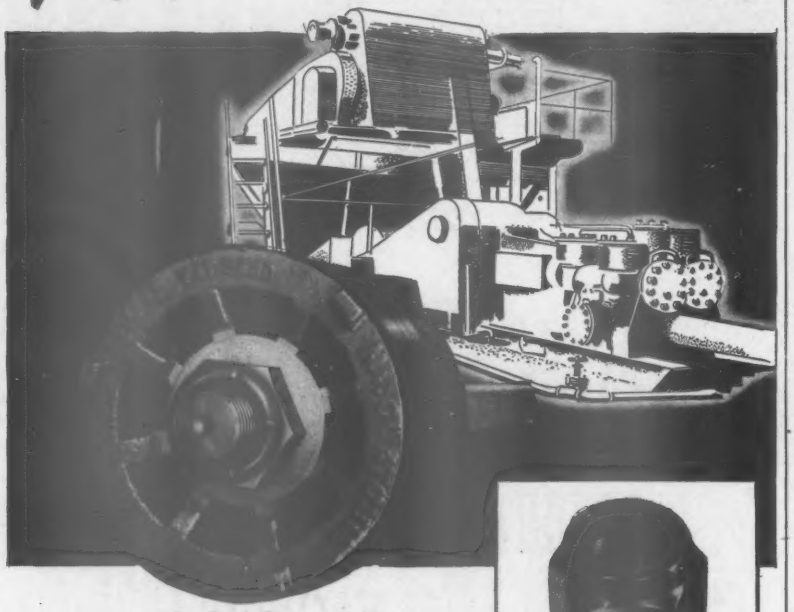

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set to their 1 Minnie Templeton, recent northwestern Coleman County pool opener 1½ miles northwest of Silver Valley. The new test is 1 Cope Estate, 330 ft. out of the northeast corner of Section 1, HT&B Survey.

Jones County Regular field had two completions, and Santa Anna field, Coleman County, had one. Each of these fields had one new location. Stephens County Regular field has six drilling wells, Reddin field, Taylor County, three and Loving field, Stephens County, and Eastland and Palo Pinto County Regular fields each have two.

WEST CENTRAL TEXAS WILDCAT FAILURES

Eastland County: J. W. Sewell 1 J. H Buchanan, Sec. 25, Blk. 2, ETRR Sur., 2 mi. NW Rising Star, elev. 1,652 ft., dry in Strawn, TD 1,150 ft.

Palo Pinto County: Dunn-Powell-Kirby 1 J. D. Johnson, J. W. Clark Sur. A-1659, 3¾ mi. SW Graford, elev. 1,049 ft., dry, TD 1,501 ft.

Shackelford County: Neely & Neely 1 Joe Carlile et al, Sec. 212, ETRR Sur., 4½ mi. NW Budmathews, elev. 1,605 ft., dry in Swastika, TD 1,851 ft.

EASTERN TEXAS

Discovery Near Avinger Will Test Travis Peak

DALLAS.—Magnolia Petroleum Co. and Seaboard Oil Co. 1 Orr, Fowler Survey, northwestern Marion County discovery 3 miles southwest of Avinger, which opened the first Cotton Valley gas-distillate production in the state, was being reperforated to test the Travis Peak from 7,586-88 ft.

When this section was drilled, the well showed for possible commercial production on a test which had a recovery of 1,100 ft. of 39-gravity oil and 200 ft. salt water in 25 minues. Rogers Lacy and Allied Oil Co. 1 J. M. DeWare, J. M. Walker Survey, in the Jefferson area of Marion County, was waiting on orders at 7,150 ft.

Barnsdall Oil Co. 1 Sohio Petroleum Co. 1 Pickering, Sevey Survey, Smackover wildcat 3 miles southwest of Texarkana, Bowie County, was being reamed to deepen below 7,258 ft. where it is believed the Smackover was based as the formation now is red sand and shale of the Eagle Mills. No shows have been reported since 7,094 ft. Delta Drilling Co. 1 Martin, S. A. Flowers Survey, Travis Peak wildcat 10 miles south of Canton in Van Zandt County, was drilling below 7,050 ft. in lime and shale.

W. B. Hinton will drill 1 Betts in the A. B. Beard Survey, a Travis Peak wildcat 4 miles southeast of Marietta in Cass County. Humble Oil & Refining Co. 1 Freeman, John Little Survey, wildcat 3 miles southeast of Brushy Creek, continues to fish for drill pipe. Total depth is 11,869 ft.

Hawkins field, Wood County, had six completions this week, and Talco and New Hope fields, Franklin County, and Pickton field, Hopkins County, each had one. Hawkins field had eight locations, and Opelika field, Henderson County, and Carthage field, Panola County, each had one. Carthage field has 25 drilling wells, Hawkins field 24, New Hope field, Franklin County, 7; Sand Flat field, Smith County, 6; Waskom field, Harrison County, 5.

EASTERN TEXAS SUCCESSFUL WILDCATS

Rusk County: New gas-distillate pool—Chicago Corp. (was Delta Drlg. et al) 1 C. G. Rayford, J. Smith Sur., 2 mi. S Henderson, elev. 390 ft., flowed 13 bbl. distillate with 365,000 cu. ft. gas per day through ½-in. choke, perf. 7,310-

25 ft., 7,345-54 ft. and 7,362-85 ft. Travis Peak, gravity 61.3°, TD 7,519 ft.

Shelby County: New gas-distillate pool—Humble 1 Pickering Lumber Co., S. Francois Sur., 14 mi. E Shelbyville, elv. 247 ft., flowed 15,000,000 cu. ft. gas with 13 to 15 bbl. distillate per mil. cu. ft. gas per day, perg. 6,606-28 ft. Pettit, gravity 56°, TD 12,221 ft.

EASTERN TEXAS WILDCAT FAILURE

Limestone County: Nu-Enamel 1 Bessie Erskine, C. A. Ogsberry Sur., 4 mi. S Big Hill, elev. 478 ft., Pettit 5,160 ft., Travis Peak 5,330 ft., Cotton Valley 6,440 ft., dry, TD 7,851 ft.

CANADIAN FIELDS

New Turner Valley Well Shows 509 Bbl. Daily

CHATHAM, Ont.—Official figures of recent Turner Valley completions show, in the north extension, Foothills Oil & Gas 23, LSD 3, 9-21-3w5, with 509 bbl. daily of 40-gravity crude and 612,000 gas from the Madison from 8,320-8,706 ft. In the north central area, Royalite Oil 85, LSD 3, 2-20-3w5, with Madison from 8,198-8,476 ft. made 123 bbl. of 40-gravity crude with 123,000 gas.

In the north extension, Continental 1, LSD 8, 4-21-3w5, finished with Madison from 7,918-8,745 ft. has acidized with indications of a marked increase over its 120-bbl. daily natural production. In the North Central area, Royalite-Lowery 5, LSD 12, 11-20-3w5, with Madison from 7,966-8,201 ft. made around 144 bbl. natural production and is acidizing.

Brazeau.—On the Brazeau structure, separator tests of Home-Brazeau 1, LSD 6, 17-43-17w5 are continuing on its gas flow from the upper Madison at 9,498-9,597 ft. Tests indicate only a small recovery, a flow of 6,680,000 cu. ft. with pressure of 975 lb. on tubing, 1,050 lb. on casing, and 210 lb. on separator yielding a few barrels of 51.7° crude.

New development campaign.—Merger of reservation interests covering around 1,150,000 acres of Crown and C.P.R. leases in Alberta for purposes of systematic development has been undertaken by Home Oil Co., Anglo-Canadian Oil Co. and Calgary & Edmonton Corp. Stanley E. Slipper, consulting geologist of Calgary, will start preliminary work this spring and plans include spending $250,000 in geophysical work this year with a drilling program to start in 1947. Holdings covered by the agreement comprise six new areas in Alberta, mainly in the north. The areas are West Viking, 188,542 acres in townships 44 to 49, ranges 15 to 17w4; Beaverhill Lake, 146,151 acres, townships 50 to 53, ranges 16-18w4; Fort Augustus, near Fort Saskatchewan, 511,736 acres, townships 55-55. ranges 21-23w4; Elk Point, 83,994 acres, townships 55-57, ranges 4-6w4; Wabamun Lake, 179,160 acres, townships 50-52, ranges 3-6w5; Notikewin River, 481,194 acres, townships 90-95, ranges 20-24w5.

Keystone Valley.—On the Keystone Valley structure in the Alberta foothills, Roxana 3-K, LSD 7, 31-27-6w5, has encountered additional gas with traces of oil in lower cardium sandstone at 3,410 and 3,426 ft., increasing the flow to around 2,000,000 cu. ft.

Stolberg.—In the Stolberg area of the central Alberta foothills, Imperial-Shell-Stolberg 1, LSD 3, 22-41-14w5, is the deepest active drilling operation in Alberta, below 11,742 ft. The test reached the Dalhousie sand at 11,646 ft. and the Kootenay at 11,713 ft. The only deeper well ever drilled in Alberta was Imperial-Coalspur 1, LSD 10, 3-49-21w5, abandoned last year at 12,955 ft.

Narraway River.—Phillips Petroleum Co. (U. S.) has taken up a reservation of 175,952 acres in northwestern Alberta close to the British Columbia boundary. The acreage lies just east of the Narraway River and northwest of the Kakwa River, in townships 61-63, ranges 10-12w6, and townships 62-63, range 13w6.

ILLINOIS

New McClosky Pool May Be Opened in Gallatin County

MATTOON.—R. B. Martin and Deep Rock Oil Corp. have apparently opened a new pool in Gallatin County with the 1 Pioneer Trust & Savings Bank, NW NE SE 2-8s-8e. After an acid treatment of 2,000 gal. in the McClosky lime at 2,944-52 ft., total depth 2,990 ft., the well showed 33 bbl. of oil in 24 hours. Swabbing tests are now under way. The 1 Pioneer Trust & Savings Bank is located about 2 miles northeast of production in the North Inman field and should lead to additional drilling in the immediate area.

C. E. Brehm et al 1 Fred Blessing, NE NE NE 31-1n-8e, shows prospects of opening a new pay zone for the Geff pool of Wayne County. This well, a northeast outpost of the field, has casing set for a test of saturation found in the Levias lime 3,102-12 ft. A 40-min. drill-stem test at this depth recovered gas in 15 minutes and 1,500 ft. of clean oil with no water showing.

Another excellent producer was reported for the West extension area of the Calhoun pool during the past week. The Pure Oil Co. 1 M. Gallagher, SW SW SW 12-2n-9e, Richland County, flowed at the rate of 786

bbl. of oil daily following an acid treatment of 5,000 gal. in the McClosky lime at 3,166-74 ft. Total depth of the new producer is 3,181 ft.

Illinois completions during the past week totaled 32, including 22 oil wells and 10 dry holes. Six wildcat tests were completed, all dry. The Mattoon field led in completions with 10 oil wells and 1 dry hole. The remainder of the wells were divided among the basin pools.

New operations reported included 15 wildcats, 2 each in Hamilton, Cumberland, Edwards and Jasper counties, and 1 each in Randolph, Lawrence, St. Clair, Clay, Richland, Macoupin, Shelby, and Fayette counties. New field operations totaled 56, of which 15 were in Wayne County, 11 in Coles, and 6 in Clay.

ILLINOIS WILDCAT FAILURES

Clinton County: J. H. Fedler 1 L. Gullick, NW SE NW 28-2n-1w, dry at 1,456 ft., Cypress sand 1,313 ft., Benoist sand 1,449 ft.

Coles County: Harry Miller 1 Berkley, SE SW SE 12-11n-6e, dry at 502 ft., slight show oil 433-38 ft., show oil and water 481-95 ft.

Cumberland County: Nash Redwine 1 McKinney-Kingery, NE SW NW 18-9n-8e, location abandoned.

Hamilton County: National Associated Pet. Co. 1 Wilson, NE NE SE 26-5s-7e, dry at 3,554 ft., Glen Dean 2,739 ft., Barlow 2,991 ft., Renault 3,312 ft., Aux Vases sand 3,345 ft., Ste. Genevieve 3,386 ft., McClosky 3,426 ft.

Jasper County: J. W. Rudy 1 First National Bank, S½ SW NE 30-7n-11e, dry at 2,641 ft., Glen Dean 2,046 ft., Barlow lime 2,151 ft., Ste. Genevieve 2,480 ft., Fredonia 2,513 ft., McClosky 2,518 ft.

Shelby County: Big Four O. & G. 1 D. Horn, SW SW SW 19-12n-5e, dry at 2,350 ft., Tar Springs sand 1,552 ft., Glen Dean 1,560 ft., Cypress sand 1,665 ft., old well deepened from 1,930 to 2,350 ft.

Wayne County: Taylor & Duncan 1 Nichols, SW NW NW 18-2s-6e, dry at 3,320 ft., Glen Dean 2,584 ft., Barlow 2,787 ft., Cypress sand 2,853 ft., Renault 3,079 ft., Aux Vases sand 3,098 ft., Ste. Genevieve 3,172 ft., Levias 3,186 ft., Fredonia 3,224 ft., McClosky 3,225 ft.

ROCKY MOUNTAIN

Rocky Mountains' Deepest Well Gets Gas, Condensate

DENVER.—A discovery is reported on the big Church Buttes Structure, northeastern corner of Uinta County, southwestern Wyoming, in Mountain Fuel Supply Co. 1 Government, C SW NW 8-16n-112w, in the deepest hole drilled in the Rocky Mountain area. It is a joint operation with Union Pacific Railroad. It is a "tight" hole and only meager information has been released, but William T. Nightingale, vice president of Mountain Fuel Supply Co., says testing started April 7 and will continue for a week before capacity of the well is determined. He added "we have a very large discovery of gas and condensate."

Total depth is 12,894 ft. A string of 6⅝-in. casing was cemented at 12,878 ft., and the hole plugged back to that depth. The gas and condensate is being tested through perforations in the pipe. The volume nor the formation in which it was found, nor the location of the perforations are not disclosed. However, gas was reported in cores at 12,492 ft.

When drilling was started in February 1945, it was expected that 6,000 to 7,000 ft. of Tertiary beds would be drilled and the hole carried to 10,000 to 11,000 ft. When it reached a depth of 11,162 ft., a string of heavier rotary tools was moved in. The 9⅝-in. was cemented at 6,940 ft., possibly a marker for the base of the Tertiary beds. At that time the Frontier was expected at 12,000 ft., but is reported to have been picked up at 11,751 ft. While the bottom formation is not revealed, it is believed drilling stopped near the top of the Morrison formation and that the gas and condensate may be coming from the Dakota. The structure, which is said to be a very large one, is in an area where little deep testing has taken place in the past, and is located near the Mountain Fuel Supply natural-gas trunk line from Baxter Basin, and Hiawatha fields to Salt Lake City.

River Dome wildcat.—Pure Oil Co. 1 Unit, NE NE NW 18-48n-92w, River Dome, Washakie County, Wyoming, which is showing for a discovery out in the Big Horn basin in the Embar formation through casing perforations from 9,990-10,055 ft., has not yet succeeded in making a production test. After flowing 6 bbl. per hour for 12 hours, attempts were made to acidize the formation. However, all efforts to buck the formation pressure failed, and a pressure control crew from the Mid-Continent field was rushed in and now is at work at the well. They expect to succeed within the next few days. One report states that indications of the presence of carbon dioxide gas have shown up, resulting in the freezing of the tubing. The company's No. 2 Unit, a little more than a mile to the north, which will test the Embar, is drilling at 8,176 ft.

More gas at Table Rock.—Texas Co. 1 Unit, SE NW NW 1-18n-98w, Table Rock structure, Sweetwater County, Wyoming, which is showing for a discovery, is bottomed at 3,831 ft., with the 7-in. at 3,376 ft. In a 7-hour test through perforations at 3,341-42 ft., it made 1,560,000 cu. ft. of gas with a spray of water. Previous to

(Continued on page 202)

OHIO, KENTUCKY

Lorain County Well Shows Signs of New Gas Pool

COLUMBUS, Ohio.—The second earmark of a new gas pool in western Pittsfield Township, Lorain County, was found by Hanley & Bird on Eliza Watkins, Lot 88. The Clinton sand from 2,166-72 ft. gaged 286,000 cu. ft. of natural gas.

These indications of gas, 3 miles west of the supposed sand pinchout, will encourage a search for other pools west of the field. In the same township, Ohio Fuel 2 E. R. McConnell, Lot 137, extends the North Wellington pool ½ mile north. The Clinton found from 2,205-16 ft. gaged 1,520,000 cu. ft. of gas. Two additional locations have been approved in the north part of the pool.

In Eaton Township, Lorain County, Ohio Fuel 1 Julia Visneck, Lot 84, gaged 1,387,000 cu. ft. with the sand logged from 2,458-74 ft. This is the second well in three attempts to open a pool in the western part of the township.

Seven additional locations were staked around the city of Canton. Ashland field reported six locations, Brush Creek five, Cambridge and Mt. Vernon three each. Seventeen wells were completed, scattered about evenly over the various fields.

OHIO SUCCESSFUL WILDCAT

Columbiana County, Hanover Township: Frank Lyons 1 Anita B. Wright, Sec. 10, Clinton 5,766-5,880 ft., 100,000 cu. ft., TD 5,880 ft.

EASTERN KENTUCKY

ASHLAND.—Activities in the Eastern Kentucky field of operations were narrowed down to one gas and an oil well completion during the past week.

Kentucky-West Virginia Gas Co. completed well No. 5,527 on the James A. Greer property in Pike County, total depth 3,778 ft., open flow of 169,000 cu. ft. of gas in shale.

J. P. Perry completed well No. 3 on the Ike Brown property on South Fork in Powell County, total depth 833 ft., estimated daily production 3 bbl.

WESTERN KENTUCKY

OWENSBORO.—Location has been staked for a new wildcat in Henderson County, the Fisher Oil 1 M. Barker, 8-O-22. This well is located 1 mile south of Corydon and about 2 miles north and slightly north of production in the Dixie pool. Other new operations reported during the past week included one development well for McLean County and one for Henderson County.

Completions in the Western Kentucky area during the past week totaled six, of which two were small oil wells and four were dry holes. No wildcat completions were reported.

INDIANA

EVANSVILLE.—In Posey County H. E. Ledbetter et al 1 N. Utley, SE NW SW 30-5s-13w, is bailing mud for a test of the McClosky at 3,007-11 ft., total depth 3,111 ft. A 90-minute drill-stem test at this depth recovered 630 ft. oil, 180 ft. of oil-cut mud, 70 ft. of drilling mud and no water. The 1 Utley is about 2 miles southeast of the Mink Island area of the Griffin-New Harmony Consolidated field.

Two excellent producers were completed in Indiana during the past week. In the South New Harmony field, R. E. Johnston et al 2 Elliott, NW SW 23-5s-14w, pumped 565 bbl. of oil a day from the Waltersburg sand at 2,123-35 ft. and 2,145-50 ft., total depth 2,151 ft., following a 50-qt. shot. In the North Owensville field, C. Wood 1 J. H. Spore, NW NW NE 19-2s-11w, pumped at the rate of 500 bbl. of oil daily from the McClosky, total depth about 2,340 ft.

Completions for the past week totaled eight, of which four were oil wells and four were dry holes. No wildcat completions were reported. New operations totaled five and included 2 wells in Gibson County and three in Posey County.

APPALACHIAN FIELD

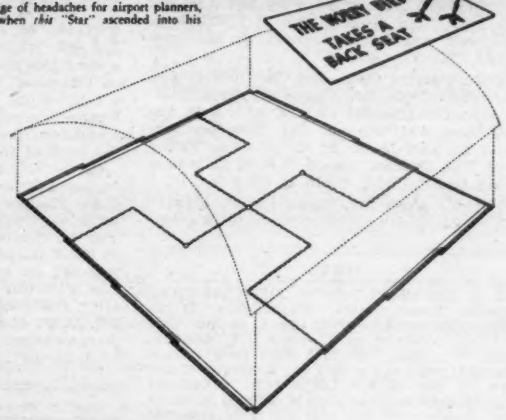
Baileysville District Well Has Large Gas Flow

PITTSBURGH.—In the new development in Baileysville district, Wyoming County, West Virginia, United Producing Co. completed another large Berea gas well, 1,307 W. M. Ritter Lumber Co., with a final open flow of 4,640,000 cu. ft. of gas. The surface elevation is 1,450 ft., Big Lime 2,349-2,747 ft., Berea 3,382-3,415 ft., not shot, rock pressure 830 lb. 48 hours, and total depth 3,416 ft.

In Grant district, Ritchie County, A. R. Kelly et al completed drilling in 2 O. C. Beckner with an estimated production of 25 bbl. or better from the Injun, Berea and shale below the Berea where a pay was struck at possibly the Warren sand horizon of the Upper Devonian. While the area is spotty with oil and gas, it may be the forerunner of a new local pool and is located about 26 miles east of Parkersburg on Buffalo Run of Hughes River. Gas shows were struck at 1,815-20 ft., 1,865-72 ft., 1,945 ft., oil at 2,117-28 ft., gas 2,318-22 ft., gas 2,413-18 ft., and largest oil and gas 2,473-77 ft., total depth 2,477 ft.

Economy · Durability · Flexibility

This Worry Bird was in charge of headaches for airport planners, but retired to a back seat when *this* "Star" ascended into his heckler's heaven.



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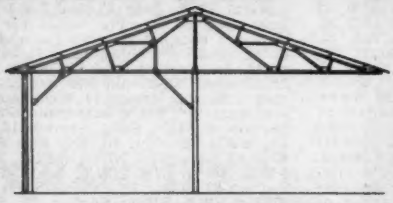
When you say, "It's best by far to depend on Star," you're not "Just Whistling Dixie." Whatever or wherever the problem, Star has a good answer, based on workmanship and materials proven in actual use.

Star's "Square-T" hangar is designed to meet all situations where space is at a premium. It reduces housing space by as much as 15%, provides simple yet rigid construction at unusually low cost.



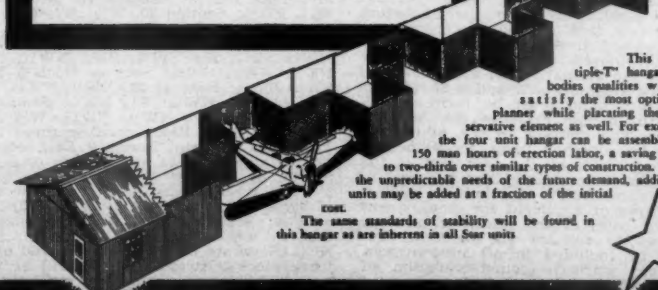
Star Standard Multihanger

Height 10 Feet
Depth 30 Feet
Width 42 Feet

Detail of special Star cantilever type truss with 4"—13.8 lb. per foot H Beam columns.

2+2=5

When builders add up the comparative costs of materials and labor, they find they can have sturdy steel construction for less money, with a plus element of flexibility. Thus, 2+2=5



This "Multiple-T" hangar embodies qualities which satisfy the most optimistic planner while placating the conservative element as well. For example, the four unit hangar can be assembled in 150 man hours of erection labor, a saving of up to two-thirds over similar types of construction. When the unpredictable needs of the future demand, additional units may be added at a fraction of the initial cost.

The same standards of stability will be found in this hangar as are inherent in all Star units

STAR MANUFACTURING COMPANY

3012 S. STYLES OKLAHOMA CITY, OKLAHOMA

New locations in West Virginia totaled 11 and were situated in Cabin Creek district, Kanawha County; Duval district, Lincoln County; Hamilton district, Nicholas County; Teays Valley district, Putnam County; Harper district, Roane County; Meade district, Upshur County; Grant district, Wayne County; Harris district, Wood County, and Oceana district, Wyoming County.

New locations in southwest Pennsylvania totaled seven and were located in Beaver Township, Jefferson County; Bethel and Kittanning Townships, Armstrong County; Porter Township, Clarion County, and Georges and Luzerne Townships, Fayette County.

LA.-ARK.

New Producing Sand Zone Opened in Iberia Field

SHREVEPORT.—A new producing sand zone has been opened in the New Iberia field in Iberia Parish. The Humble Oil & Refining Co. 2 Romero, in 49-12s-7e, flowed 259 bbl. after perforations at 9,683-87 ft. The well was drilled to 9,844 ft. and pipe set at 9,735 ft.

Testing at the California Co. 1 Ida Rogers Richards, 11-18n-2w, Choudrant area, Lincoln Parish, resulted in 1,500,000 cu. ft. gas and some distillate per day from perforations at 9,312-22 ft. in the Cotton Valley sand. The Bodcaw topped at 9,100 ft. is now being tested. Total depth is 9,343 ft.

Samples from the Barnsdall Oil et al 1 Moore, 34-17s-24w, McKamie area, Lafayette County, Arkansas, indicate a gas-distillate producer. The hole has been drilled to 9,312 ft. and pipe set on bottom.

Arkansas reported no wildcat completions. One oil and one dry were completed in Stephens. Wesson added a producer with an initial production of 120 bbl. Smackover and Dorcheat-Macedonia each added one oil well.

North Louisiana had two wildcat failures in Bienville Parish. Of the 11 field wells completed, 4 were oil, 3 were gas and 4 were dry.

NORTH LOUISIANA WILDCAT FAILURES

Bienville Parish: C. G. Gasscock 1 L. & E. Hightower, 370 ft. north and 460 ft. east of southwest corner of SE SE 5-15n-7e, dry at 4,502 ft.

J. M. Hazelwood 1 Walden-Baker, 190 ft. north of center of NW SW 36-16n-9e, dry at 5,303 ft.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, General Land Office, Washington, D. C. Notice is hereby given that sealed bids will be received until noon on Monday, April 29, 1946, for land described herein situated within the known geologic structure of the Mosby Dome, Cat Creek oil field, Montana. This land is offered to qualified bidders of the highest cash amounts per acre as a bonus for the privilege of leasing the land under section 17 of the leasing act as amended by the Act of August 21, 1935 (49 Stat. 674, 30 U.S.C. sec. 226), in the following parcels, all in T. 15 N., R. 30 E., P.M.; Parcel No. 1, sec. 22, S½NW¼, 80 acres; Parcel No. 2, sec. 22, NE¼SW¼, NW¼SE¼, 80 acres; Parcel No. 3, sec. 22, S½SW¼, 80 acres; Parcel No. 4, sec. 22, S½SE¼, 80 acres; Parcel No. 5, sec. 26, S½ NW¼, SW¼NE¼, 120 acres. Total 440 acres. Bids must be submitted on each parcel separately, but if two or more parcels are awarded to the same bidder they may be included in a single lease. Each bidder must submit with the bid one-fifth of the amount bid in cash, or by certified check made payable to the order of the Treasurer of the United States, and file the showing of qualifications to receive a lease, required under 43 CFR 192.19. The envelopes should be plainly marked "Bid for Parcel No. , Mosby Dome, Cat Creek oil field. Not to be opened before noon, April 29, 1946." No bids received after the hour fixed herein for receiving bids will be considered. The remainder of the bonus and the annual rental at the rate of $1 per acre must be paid and a $5,000 corporate surety bond must be furnished by a successful bidder prior to the issuance of a lease. The deposits of the other bidders will be returned upon acceptance of the successful bids by the Secretary of the Interior. The successful bidder will be required to agree not to discriminate against any employee or applicant for employment because of race, creed, color, or national origin, and to require an identical provision to be included in all subcontracts. Bidders are warned against violation of section 59, U. S. Criminal Code, approved March 4, 1909, prohibiting unlawful combination or intimidation of bidders. The right is reserved to reject any and all bids in the discretion of the Secretary of the Interior. Fred W. Johnson, Commissioner.

OKLAHOMA

New Producing Horizon for Old Weleetka Pool Indicated

DOAK & HUGHES 4 Community, NW SW NE 16-10n-11e, may have opened a new pay zone for the old Weleetka pool of Okfuskee County. This well, drilled to a total depth of 2,832 ft., topped the upper Pennsylvanian at 2,830 ft. On a test of this formation, the 4 Community flowed oil at the rate of 150 bbl. a day.

Carter Oil Co. is testing the Viola lime in the 1 Thompson, NE SE 36-8n-4w, McClain County wildcat east of Blanchard, with the belief that commercial results may be obtained. The well was drilled out to 10,430 ft., plugged back depth, and casing was set on top of the Viola at 10,120 ft. The well was acidized with 5,000 gal., and, after swabbing, cleaned itself making 750,000 cu. ft. of gas and a spray of oil. It was then swabbed and made 3 bbl. of fluid per hour, 50 per cent oil and no water. On continued testing the output dropped to 2 bbl. of fluid an hour, 14 per cent acid water and 14 per cent mud, with 500,000 cu. ft. of gas.

R. H. Dearing & Sons will complete their Garvin County discovery, the 1 McBride, NE NW NW 30-4n-2w, for a potential of 192 bbl. of high-gravity distillate and 2,160,000 cu. ft. of gas per day through ½-in. choke. Casing pressure is 620 lb. and tubing pressure 208 lb. The last 6 hours of its testing period, the 1 McBride made 46 bbl. through the ½-in. choke. Considerable trouble was experienced throughout the past week in testing this well due to its continual freezing up.

Oklahoma Natural Gas Co. 1 Green, NW NW NW 6-17n-14w, Dewen County wildcat, is drilling ahead after a drill-stem test of the Layton at 7,697-7,725 ft. blew air and the packer failed. A possible staining was encountered in the Layton, topped at 7,690 ft., and operators cored 7,710-25 ft., recovering 14 ft. of gray, hard tight sand. The old Magnolia test drilled several years ago to the north of the 1 Green also had a show in the Layton.

OKLAHOMA SUCCESSFUL WILDCAT

Hughes County: O. H. Grimes 1 Meaders,

(Continued on page 202)

LEGAL

UNITED STATES DEPARTMENT OF AGRICULTURE, Forest Service, Jackson, Mississippi, April 12, 1946. Sealed bids in duplicate will be received until 10:00 A. M., Central Time, May 13, 1946, and then publicly opened, offering bonus for operating rights in connection with gas and oil leases on three blocks of national forest land, located in Forrest and Franklin Counties, Mississippi. Block number one all in Township 1 South, Range 13 West, contains approximately 2,079.98 acres, more or less, in Section 10, NE¼ SE¼; Section 15, W½ E½; E½ SW¼; Section 20, E½ E½; Section 21, E½ NE¼; SW¼ NE¼; SE¼; E½ SW¼; NW¼ SW¼; W½ NW¼; and NE¼ NW¼; Section 22, NE¼; E½ NW¼; SW¼ SE¼; S½ SW¼; NW¼ SW¼; Section 26, SE¼ SE¼; SE¼ SW¼; Section 27, SE¼; S½ SW¼; W½ NW¼; Section 28, N½. Block number two all in Township 1 South, Range 13 West, contains approximately 2,082.05 acres, more or less, in Section 19, SW¼ SE¼; SE¼ SW¼; Section 20, W½; W½ E½; Section 28, S½; Section 29, E½ SE¼; SE¼ NE¼; SW¼ SW¼; Section 30, S½ SE¼; NW¼ SE¼; E½ SW¼; SE¼ NW¼; NW¼ NE¼; NW¼ SW¼; Section 31, N½ NE¼; SW¼ SW¼; Section 32, NW¼ NW¼; Section 34, N½ NW¼; E½ NE¼; Section 35, S½ NW¼; NW¼ NW¼; SW¼; W½ SE¼; and SE¼ SE¼. Block number three all in Township 6 North, Range 3 East, contains approximately 572.61 acres, more or less, in Section 19, S½ Lot 5; Section 22, Lots 6; 7; 8, less 4 acres; 9, less 5 acres; and the north 12 acres in Lot 15; Section 23, Lots 9; 10; 15 and 16; Section 25, 142.97 acres, more or less, in west part; and Section 37, NW¼ NE¼. Separate bids will be received on the three blocks. Award of lease will be made only to bidder who can show sufficient experience and financial resources and prove citizenship. Interested parties may obtain bid documents, lease forms and operating regulations from the Forest Supervisor, Masonic Building, U. S. Forest Service, Jackson 114, Mississippi.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, General Land Office, Washington, D. C. Notice is hereby given that sealed bids will be received until noon on Wednesday, May 1, 1946, for land described herein situated within the known geologic structure of the Wilson Creek oil field, 6th P. M., Colorado. This land is offered to qualified bidders of the highest cash amounts per acre as a bonus for the privilege of leasing the land under section 17 of the leasing act as amended by the Act of August 21, 1935 (49 Stat. 674, 30 U.S.C. sec. 226), in the following parcels: T. 2 N., R. 94 W., Parcel No. 1, N½NE¼, SE¼NE¼ sec. 10, 120 acres, Parcel No. 2, NW¼ sec. 11, 160 acres. Parcel No. 3, NE¼ sec. 11, 160 acres. Parcel No. 4, N½SW¼ sec. 11, 80 acres. Parcel No. 5, SE¼ sec. 11, 160 acres. T. 3 N., R. 94 W., Parcel No. 6, SW¼ sec. 13, 160 acres. Parcel No. 7, S½SE¼ sec. 13, 80 acres. Parcel No. 8, NE¼ sec. 24, 160 acres. Parcel No. 9, W½SE¼ sec. 24, NW¼NE¼ sec. 25, 120 acres. Total, 1,200 acres. These lands lie within the approved area of the Wilson Creek unit agreement, and in accordance with 43 CFR 192.39, any successful bidder will be required to file, prior to the issuance of a lease, evidence that he has entered an agreement with the unit operator for the development and operation of the lands in the proposed lease under and pursuant to the terms and provisions of the approved unit agreement, or an affidavit giving satisfactory reasons for the failure to enter into such agreement. Bids must be submitted on each parcel separately, but if two or more parcels are awarded to the same bidder they may be included in a single lease provided the combined acreage does not exceed 640 acres. Each bidder must submit with the bid one-fifth of the amount bid in cash, or by certified check made payable to the order of the Treasurer of the United States, and file the showing of qualifications to receive a lease, required under 43 CFR 192.19. The envelopes should be plainly marked "Bid for Parcel No. .., Wilson Creek oil field. Not to be opened before noon, May 1, 1946." No bids received after the hour fixed herein for receiving bids will be considered. The remainder of the bonus and the annual rental at the rate of $1 per acre must be paid and a $5,000 corporate surety bond must be furnished by a successful bidder prior to the issuance of a lease. The deposits of the other bidders will be returned upon acceptance of the successful bids by the Secretary of the Interior. The successful bidder will be required to agree not to discriminate against any employee or applicant for employment because of race, creed, color, or national origin, and to require an identical provision to be included in all subcontracts. Bidders are warned against violation of section 59, U. S. Criminal Code, approved March 4, 1909, prohibiting unlawful combination or intimidation of bidders. The right is reserved to reject any and all bids in the discretion of the Secretary of the Interior. Fred W. Johnson, Commissioner.

MISSISSIPPI

Fayette Field Has First Dry Well Completion

JACKSON.—Humble Oil & Refining Co. 1 J. Fred Gordon, 400 ft. south of northeast corner along east line and 354 ft. west at right angle to location in 25-9n-1w, is the first well completed as dry in Fayette field, Jefferson County. A drill-stem test at 9,616 ft. recovered 450 ft. of oil-cut mud and water. Another drill-stem test at 9,618 ft. recovered mud and salt water. Total depth was 9,774 ft. The well may be reworked later.

Humble B-1 Masonite, 1,780 ft. north and 660 ft. east of southwest corner 21-9n-7w, wildcat in Wayne County, is being drilled below 8,000 ft. in shale and lime. A drill-stem test at 7,832-41 ft. recovered 90 ft. of mud and 5,800 ft. of salt water.

Levan S. Akers 1 J. D. Whitaker, NW NW 23-3s-10e, wildcat in Tishomingo County, is shut down waiting on orders. Total depth is 2,117 ft. Tuscaloosa was topped at 100 ft., Iuka chert 310 ft., Ferndale shale 1,035 ft. and Knox 1,775 ft.

No wildcat completions were reported from Mississippi. Baxterville, Cranfield, Eucutta, Gwinville, and East Heidelberg fields each added one oil producer.

FLORIDA WILDCAT FAILURE

Gilchrist County: Sun Oil Co. 1 Alto Adams et al, 600 ft. north and east of southwest corner of 15-9s-15e, dry at 3,753 ft., quartzite 3,753 ft.

KANSAS

Sedgwick County May Have New Pool Near Wichita

PROSPECTS looked bright for a new pool about 2 miles northeast of Wichita, Sedgwick County, with reports of a fill-up of 2,300 ft. of oil in 6 hours in the Beech Aircraft Corp. 2 Hinkle, SE NE NE 1-27-1e. The pay formation is the Burgess sand at 2,986 ft., directly above the Mississippi lime. The well was killed after oil slopped over the top of the hole. The wildcat is 3 miles west of nearest production in the North Eastborough pool. Beech 1 Hinkle, ⅜ mile southeast of Beech 2 Hinkle, had several shows of oil but was completed as a dry hole last fall.

Oil shows are being tested in the Mississippi lime at the Deep Rock Oil Corp. 1 Whitmer, NW NW SE 10-30-9w, wildcat in southwestern Kingman County. Gas and oil-cut mud was recovered in a drill-stem test in the Mississippi at 4,295-4,345 ft. No shows were reported from the Arbuckle at 4,926 ft. Nearest production is the Cunningham pool, 16 miles to the northwest.

Nelson Drilling Co. and J. C. Dozier 1 Jansen, NE SE NE 21-17-8w, northwest extension to the Edwards pool in Ellsworth County, filled up with 1,200 ft. of oil. Top of the Arbuckle was marked at 3,195 ft.

Oil and gas shows in the Reagan and Heebner formations are being tested at the Darby & Bothwell 1 Wagoner, NE NE NW 28-18-16w, wildcat in Rush County. A core at 3,619-26 ft. recovered a fair show of oil in the Reagan sand and a drill-stem test in the Heebner at 3,315-26 ft. recovered 60 ft. of oil and gas-cut mud. The test is about 2 miles northeast of the Albert pool.

KANSAS SUCCESSFUL WILDCATS

Barber County: Continental Oil Co. & Kennecott Cooper 1 D. W. Skinner, SE SE NE 33-31-15w, 2,500,000 cu. ft. gas from Mississippi lime at 4,697-720 ft., TD 5,187 ft.

(Continued on page 202)

INDIVIDUAL WELL PRODUCTION RECORDS MEAN...

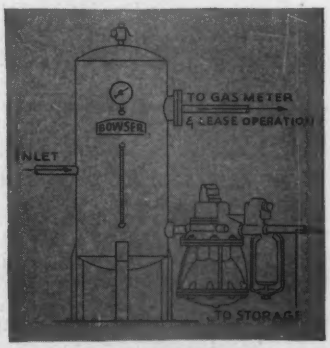
- Accurate and indisputable basis for royalty and tax payments.
- Elimination of gauge tanks, piping and handling.
- G/O ratios for conservation and reservoir study.
- Prevention of evaporation losses due to weathering.
- Quick detection of sleepers or wet wells.
- Lower transportation costs by utilization of well energy.
- Reduced fire and other hazards.
- True proportionate samples of each well's production.

QUALITY

with true proportionate sample provided by Bowser Automatic Oil Well Sampler.

QUANTITY

with Bowser Special Oil Field Meter. Dependable operation—no metal-to-metal contact.



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STATISTICS and

WEEKLY WELL COMPLETIONS . . . WEEK ENDED APRIL 13, 1946

	Total of all wells					Cum. to date		Wildcat completions and discoveries					Cumulative total, 1946				
	Comp.	Oil	Gas	Dry	Footage	1946	1945	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
New York	32	16	0	*16	27,541	444	325	0	0	0	0	0	0	0	0	0	0
Pennsylvania	66	36	3	†27	97,123	1,150	1,002	0	0	0	0	0	0	0	0	0	0
West Virginia	11	1	9	1	29,666	195	211	0	0	0	0	0	0	0	0	0	0
Ohio	17	4	10	3	37,766	301	211	0	0	1	0	1	1	0	8	11	20
Indiana	8	4	0	4	19,248	80	46	0	0	0	0	0	1	0	0	6	7
Kentucky	14	4	5	5	30,213	124	98	0	0	0	0	0	1	0	0	14	15
Illinois	32	22	0	10	80,244	554	443	0	0	0	6	6	11	0	0	92	103
Michigan	13	4	2	7	28,182	180	204	2	0	0	4	6	5	0	0	62	67
Kansas	28	18	1	‡9	94,204	560	429	2	0	1	3	6	8	0	3	65	76
Neb., Mo., Iowa	0	0	0	0	0	5	12	0	0	0	0	0	0	0	0	2	2
Oklahoma	34	21	5	8	115,116	667	657	1	0	0	3	4	19	0	10	90	119
Texas	144	93	7	44	626,618	2,209	2,022	5	1	1	23	30	52	10	7	338	407
North Central	45	25	1	§19	109,631	742	573	0	0	0	9	9	18	0	0	124	142
West	29	25	0	4	131,117	477	537	2	0	0	2	4	12	0	0	58	70
Panhandle	9	7	1	1	27,119	110	169	0	0	0	0	0	0	0	0	3	3
Eastern	14	11	1	2	94,934	207	87	2	0	0	1	3	6	0	1	30	37
Gulf Coast	30	17	4	9	204,813	514	470	1	1	1	3	6	12	8	4	71	95
Southwest	17	8	0	9	59,004	159	186	0	0	0	8	8	4	2	2	52	60
Louisiana	27	11	5	11	184,127	366	265	0	1	2	7	10	16	3	3	52	74
Northern	13	4	3	6	40,954	186	83	0	0	0	2	2	2	0	0	26	28
Southern	14	7	2	5	143,173	180	182	0	1	2	5	8	14	3	3	26	46
Arkansas	5	4	0	1	21,645	53	39	0	0	0	0	0	2	0	0	7	9
Mississippi	5	0	0	5	34,230	71	89	0	0	0	0	0	1	0	1	20	22
Southeastern States	1	0	0	1	3,753	13	9	0	0	0	1	1	0	0	0	12	12
Montana	12	9	1	2	24,601	74	75	1	0	0	1	2	3	0	0	4	7
Wyoming	0	0	0	0	0	47	61	0	0	0	0	0	5	0	2	17	24
Colorado	2	2	0	0	13,292	31	11	0	0	0	0	0	1	0	0	5	6
New Mexico	8	4	2	2	30,203	113	146	0	0	0	1	1	2	0	0	11	13
California	34	25	2	7	159,338	525	649	0	0	0	4	4	4	0	2	64	70
Utah	0	0	0	0	0	2	2	0	0	0	0	0	1	0	0	1	2
Total United States	493	278	52	163	1,657,110	7,764	7,006	11	2	5	53	71	133	13	36	873	1,055
Total previous week	541	318	42	181	1,879,892	7,271	6,476	5	1	3	54	63	122	11	31	820	984
Total April 14, 1945	529	272	60	197	1,883,369	7,006	5,363	12	1	2	62	77	175	5	39	883	1,102

Service wells included: *16, †27, ‡1, §3.

MARKET QUOTATIONS

(Quotations on other products than those shown here furnished on request. Quotations are f.o.b. plant in tank cars and in cents per gal. as of last Monday.)

REFINERY GASOLINE

Octane (A.S.T.M.)	78-80†	73-75
Mid-Continent*	6.00-6.25	5.25-5.50
Texas Gulf Coast	6.375	5.375-5.75
New York Area		7.425-7.90
California		6.00-6.875

*Basic Oklahoma Group 3. †1939 C.F.R. (research method).

NATURAL GASOLINE

Grades:	26-70	18-55
Oklahoma (Group 3)	2.750	3.300
N. Texas (f.o.b. plant)	2.250	2.700
N. Louisiana (f.o.b. plant)	2.625	3.150
California	4.875	5.500

CRUDE-OIL PRICES

Representative posted schedules per bbl.

East Texas	$1.35
Conroe	1.53
Tepetate, Louisiana, avg. grav.	1.30
Illinois Basin	1.47
Pecos County, Texas	1.05
Bradford, Pennsylvania	3.10
Van, Van Zandt County, Texas	1.18

Note: Exclusive of subsidy.

GRAVITY SCHEDULES

Top prices include all gravities above grades designated, and low prices include all gravities below grades designated:

Gravity—	Signal Hill, Calif.	Oklahoma, Kansas	Gulf Coast Texas	West Tex.*
18-18.9	$0.90	....	....	....
19-19.9	.94	....	$1.16	$0.80
20-20.9	.98	$0.95	1.18	.82
21-21.9	1.02	.97	1.20	.84
22-22.9	1.06	.99	1.22	.86
23-23.9	1.10	1.01	1.24	.88
24-24.9	1.13	1.03	1.26	.90
25-25.9	1.17	1.05	1.28	.92
26-26.9	1.21	1.07	1.30	.94
27-27.9	1.25	1.09	1.32	.96
28-28.9	1.28	1.11	1.34	.98
29-29.9	1.30	1.13	1.36	1.00
30-30.9	1.33	1.15	1.38	1.02
31-31.9	....	1.17	1.40	1.04
32-32.9	....	1.19	1.42	1.06
33-33.9	....	1.21	1.44	1.08
34-34.9	....	1.23	1.46	1.10
35-35.9	....	1.25	1.48	1.12
36-36.9	....	1.27	1.50	1.14
37-37.9	....	1.29	1.52	1.16
38-38.9	....	1.31	1.54	1.18
39-39.9	....	1.33	1.56	1.20
40 and above	....	1.35	1.58	1.22

*Includes Lea County, New Mexico.

A.P.I. REFINERY REPORT

Week ended April 6, 1946

(Figures in thousands of barrels)

	Dly. crude runs to stills	Stocks—Gasoline	Stocks—Distillate	Stocks—Residual
East Coast	751	23,549	9,990	6,349
Appalachian	146	4,093	518	433
Ill., Ind., Ky.	714	23,948	3,529	2,985
Okla., Kan., Mo.	370	9,823	1,603	1,098
Inland Texas	208	3,148	322	727
Tex. Gulf Cst.	1,102	15,608	4,546	4,194
La. Gulf Coast	301	4,135	1,435	998
N. La., Ark.	55	1,970	418	256
Rocky Mtn.	115	2,564	421	641
California	771	15,388	6,471	19,608
Total 4- 6-46	4,533	104,226	29,253	37,289
Total 3-30-46	4,684	104,715	28,240	37,746
Total 4- 7-45	4,720	96,611	27,046	40,816

CRUDE-OIL STOCKS

(Bureau of Mines Estimate)

Week ended:	Bbl. of crude*
April 6, 1946	221,214,000
March 30, 1946	224,994,000
April 7, 1945	220,871,000

*Excludes unrefinable Calif. stocks.

TRENDS

DAILY AVERAGE PRODUCTION FOR WEEK

	April 13 crude oil	Bureau of Mines April demand	April 6 crude oil
Alabama	1,100	700	1,150
Arkansas	77,950	78,000	77,450
California	856,200	834,000	855,300
Colorado	26,740	22,000	24,120
Eastern	64,400	61,900	65,850
Florida	100	100	100
Illinois	210,450	197,000	209,500
Indiana	21,450	14,000	19,150
Kansas	259,150	250,000	236,000
Kentucky	30,600	29,500	32,750
Louisiana	372,000	374,000	371,650
North Louisiana	85,200	.....	84,850
South Louisiana	286,800	.....	286,800
Michigan	49,265	46,000	46,370
Mississippi	55,050	53,000	55,850
Montana	23,910	21,000	23,460
Nebraska	750	800	750
New Mexico	95,300	99,000	95,300
Oklahoma	379,400	367,000	368,500
Texas	2,054,600	2,080,000	1,864,400
East Texas	372,000	.....	327,200
East Central Texas	139,700	.....	130,500
North Central Texas	158,700	.....	149,000
Texas Panhandle	82,000	.....	82,000
West Texas	495,000	.....	450,000
Southwest Texas	326,500	.....	295,700
Texas Gulf Coast	480,700	.....	430,000
Wyoming	102,400	92,000	95,990
Total United States	4,680,815	4,620,000	4,443,640
Change from prev. week, up	237,175		

Total production January 1-April 13 ..... 478,723,245 bbl.
Same period last year ..... 455,931,350 bbl.

CRUDE-OIL STOCKS 221,214,000 bbl. as of April 6—down 3,780,000 bbl. One year ago 220,871,000 bbl.

GASOLINE STOCKS 104,226,000 bbl. as of April 6—down 489,000 bbl. One year ago 96,611,000 bbl.

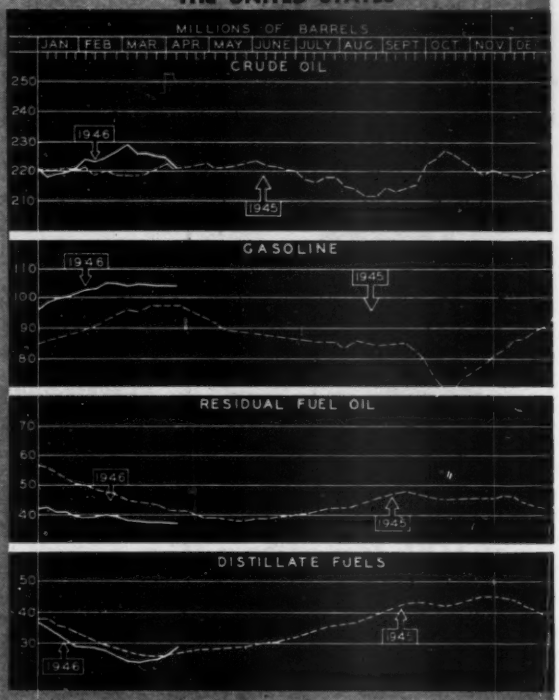
RESIDUAL FUEL-OIL STOCKS 37,289,000 bbl. as of April 6—down 457,000 bbl. One year ago 40,816,000 bbl.

GAS OIL AND DISTILLATE STOCKS 29,253,000 bbl. as of April 6—up 1,013,000 bbl. One year ago 27,046,000 bbl.

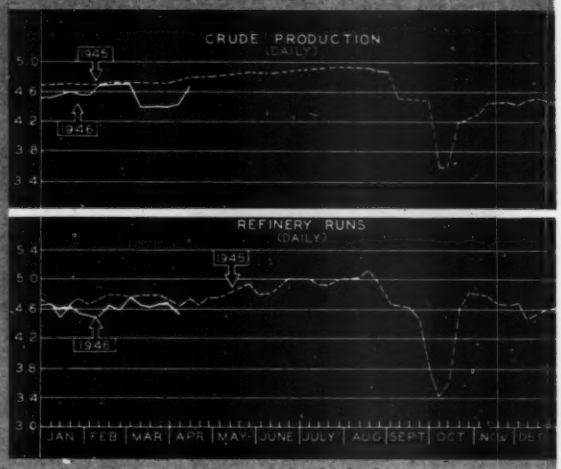
CRUDE-OIL PRODUCTION 4,680,815 bbl. as of April 13—up 237,175 bbl. One year ago 4,782,100 bbl.

REFINERY RUNS 4,533,000 bbl. daily week ended April 6—down 151,000 bbl. One year ago 4,720,000 bbl.

OIL STOCKS IN THE UNITED STATES



DAILY OPERATIONS



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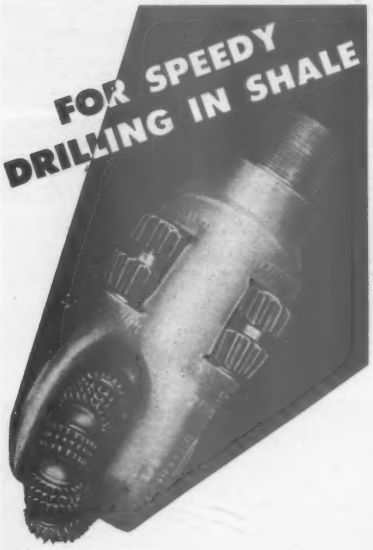

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Among the

Drilling Contractors

J. W. Carter, drilling contractor and oil operator, Fort Worth, has returned from an extended stay in Beverly Hills, Calif.

Lupher Drilling Co. has been awarded contracts to drill two wells in Isabella County, Michigan. The wells are the Sohio Petroleum Co. 1 E. L. Chapman, S½ NE NE 30-16n-6w, and Pure Oil Co. 1 Maggie Tower, N½ SE NW 5-15n-6w.

Can-Tex Drilling Co. of Calgary, Alta., has spudded Taber-Province 65-15A for California-Standard Oil Co. in LSD 11, 15-9-17w4. Location is in the West Taber field, about ¼ mile south of Taber-Province 67-15A producer.

George W. Miller Drilling Co. will drill the Gene Reagan 1 Herman & Bessie D. Luther, 330 ft. from south line and 330 ft. from east line in SE SW 19-10n-6w, Clay County, Indiana.

Phinney Bros. Drilling Co. has the contract to drill the 1 Roy McGrady Comm., SW SE NW 36-9n-11w, for Harris Oil Co. and Vanco Oil Co. in Kent County, Michigan.

Can-Tex Drilling Co. of Calgary, Alta, has spudded the McColl-Frontenac-Union Oil, 11-B-6-62-8, in LSD 11, 6-2-8w4. The well is a joint test for McColl-Frontenac Oil Co. and Union Oil Co. on acreage near the Pinhorn dome in Alberta and north of the Montana boundary.

R. & S. Drilling Co. will drill the West Michigan Consumers Co. 1 McKeough, NW NE SE 2-14n-9w, in Mecosta County, Michigan.

Cecil Chester of **Canadian Exploration Co.** of Calgary, Alta, is securing from Tulsa equipment for a second seismic crew to operate in the Alberta fields.

Keating Drilling Co. has been contracted to drill the 1 Alva Mays, NE NE NW 30-1s-2e, for Gulf Refining Co. in Jefferson County, Illinois.

W. C. Taggart Drilling Co. has been contracted by the Michigan Consolidated Gas Co. to drill the 7 Michigan Consolidated Gas Co., SW SW 3-14n-9w, and the 8 Michigan Consolidated Gas Co., NE SE 4-14n-9w, in Mecosta County, Michigan.

Harry H. Fox Drilling Co. has the contract to drill two wells in Indiana.

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One is the Jacob H. Gehl 1 Jacob H. Gehl, 300 ft. from the north line and 300 ft. from west line of NW SW 7-8n-8e, Decatur County. The second well is the T. A., Clara L. & T. F. Lux 1 Fee, NE NE 30-17n-5e, Marion County.

Union Rotary Corp. will drill the Michigan Consolidated Gas Co. 1 State-Ward, SE 31-14n-11w, Newaygo County, Michigan.

Cox Drilling Co. has drilled to 175 ft. in the Sun Oil Co. 1G Billie Minton, 2-N-22, Henderson County, Kentucky.

Harry L. McNabb Drilling Co. will drill the Rich Valley Development Co., Inc., 1 Estate of Patrick & Catherine Haulihan, SW SW 11-27n-5e, Wabash County, Indiana.

Charles W. Cook Drilling Co. will drill the 1 Maude S. Hoyer for Leonard C. Sleep in NW NW SW 14-3n-13w, Allegan County, Michigan.

Andrew S. Hoyt Drilling Co. has been contracted by Arthur J. Boeve to drill the 1 W. F. Kemmer, NE NE NE 26-3n-13w, in the Allegan field, Allegan County, Michigan.

Ace Gutosky Drilling Co. has the contract to drill a deep test in Major County, Oklahoma, for Wilcox Oil Co. The wildcat is the 1 Coulter, SW SW NW 15-22n-9w.

Ajax Drilling Co. will drill the Ray W. Matlock & Arthur E. Williams 2 Elba Gas Unit, NW 14-9n-1w, Gratiot County, Michigan.

Glenn A. Gillespie Drilling Co. in Oklahoma has moved from Holdenville to Cushing in order to operate more directly in the northern and central areas.

Sam Tennant Drilling Co. has set production casing on the 6 Warren, NW 19-28n-1e, Dilworth pool, Kay County, Oklahoma, and is moving rotary tools to 7 Warren, same quarter section.

Lupher Drilling Co. has been contracted to drill the Pure Oil Co. 1 Floyd Sides, N½ SW NW 5-15n-6w, in the Sherman pool, Isabella County, Michigan.

Appleby Drilling Co. will drill H. W. Snowden 1 Ada Walser, Section 59, Block BB, GC&SF Survey, wildcat 4 miles east of World (Powell) field, Crockett County, Texas.

Dave Duncan. Big Spring, Tex., has the contract to drill R. R. Herrell et al 1 Texas Pacific Land Trust, Section 1, Block 31, T-5-S, T&P Survey, a wildcat 15 miles west of Sterling City, Sterling County, Texas.

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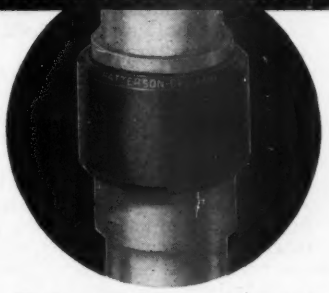

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PERSONALS

Bermingham Stays Available, Though In Retirement

A GREAT many men have retired from the oil business, but to J. A. Bermingham goes the unusual distinction of being actively retired. For the past 9 years, Jim Bermingham has been division manager of The Texas Co., South Texas producing division, and upon his retirement he was asked to remain with The Texas Co. as a consultant upon production and operating matters.

Bermingham is well known from one end of the Gulf Coast to the other. A close personal friend observed that one of the important reasons for Bermingham's success as an operator has been the fact that instead of simply accepting new ideas as they might normally appear, he has reached ahead and literally made them appear in almost every phase of his operations.

Bermingham, a product of Northwestern University, began his carreer in the oil business at the discovery of the Spindletop field in 1901. In 1927, he joined The Texas Co. Before coming to Houston in 1937, as manager of The Texas Co.'s South Texas division, he was vice president in charge of production of The Texas Co. of California. Previously, he was vice president and general manager of The Texas Production Co., a Rocky Mountain subsidiary.

William C. Kneale was advanced to acting division manager of the South Texas division, producing department, The Texas Co. He formerly was general superintendent in charge of all operations in Illinois, Indiana, Kentucky, Ohio, and other eastern states.

Roger H. Sherman, formerly an assistant manager of Creole Petroleum Corp., has been elected a vice president of the Standard Oil Co. (N. J.) affiliate. Sherman has been associated with the New Jersey Standard organization more than 18 years. He has spent the last 13 years in Venezuela directing Creole's geological activities.

C. Stacy Adams, now in Paris as representative for the Sinclair Oil companies, has been awarded the Croix de Guerre with a gold star. During the war he was a colonel and stationed in the European theater.

V. R. G. WILBUR

V. R. G. Wilbur, California independent operator, has been made president of the California Stripper Well Association succeeding **Chester F. Dolley.** New vice presidents of the association are **Edwin P. Crail,** president of Victory Oil Co.; **Earle F. Demond;** and **Jack Herley,** of Herley-Kelley. **Thomas H. Work,** Nordon Corp., association secretary-treasurer, and **Richard Fenton,** executive vice president, were reelected.

Harold D. Herndon, San Antonio, has been elected president of Mountain Producers Corp. to succeed **Gene E. Griffith,** who resigned. His headquarters will be in Denver. Herndon also is a director and president of Saltmount Oil Co., an affiliate of Mountain Producers.

Robert Siegel, assistant foreign production manager of Socony-Vacuum Oil Co., Inc., and **C. A. Moon,** chief petroleum engineer, were recent visitors in Bogota, Colombia.

A. V. Jones, Albany; **R. L. Ponsler,** Cisco; **Emmett Whiteside,** Brownwood; **Edgar Davis** and **John Byram,** Abilene; and **J. H. West,** Stamford, have been named to the executive committee of the West Central Texas Oil and Gas Association. **Joe A. Clark** and **Marshall Young,** Fort Worth, former association presidents, are ex-officio members.

W. T. Dabbs, former district superintendent for Humble Oil & Refining Co. in the Eucutta district at Waynesboro, Miss., has taken charge of Humble's new Hub district in Columbia, Miss. **S. E. Wallette,** former farm boss of the Bayou Sale district, Franklin, La., has succeeded Dabbs as Eucutta district superintendent.

Louis Franklin, Houston drilling contractor and geologist, is leaving for Jerusalem, Palestine, where he will take charge of an exploration program for Jordon Exploration Co., Ltd.

J. A. de Lanoy, vice president of Asiatic Petroleum Corp., has returned to his New York office after a business trip to the company headquarters in London.

W. C. Stevenson has been made assistant to the executive vice president of Union Oil Co. and will be in charge of industrial relations. He has been succeeded as manager of the company's Oleum, Calif., refinery by **George Hemmen.**

Frank R. Clark, vice president and division geologist of Ohio Oil Co. in Tulsa, has retired from active service with the company and will open a consulting office in Tulsa.

Peter Lindsay, former assistant mechanical superintendent at the Baltimore refinery of Standard Oil Co. of New Jersey, has been promoted to mechanical superintendent succeeding **Charles A. Hancock,** who is retiring.

Willard N. Thompson, recently released Army major, has rejoined Standard Oil Co. of New Jersey as technical assistant in the pressure distillation department at the Bayway, N. J., refinery.

Donald P. Krotz has been appointed assistant to the president of California Research Corp., Standard Oil Co. of California subsidiary. Following graduation from Stanford University as a chemical engineer, he joined California Standard at its Richmond, Calif., refinery. After 12 years in engineering, maintenance, and distillation operations there,

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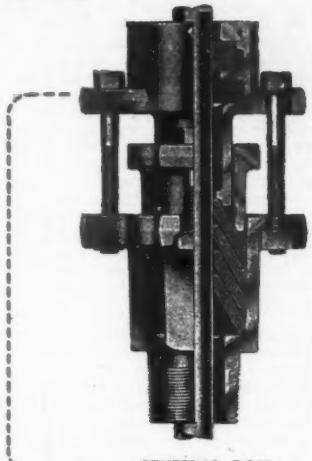

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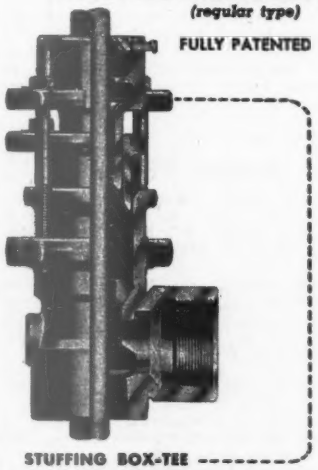

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Krotz in 1938 was transferred to Standard's department on organization in the San Francisco home office.

Com. Lemuel P. Padgett, Jr., U. S. Navy, has been awarded a Legion of Merit for his wartime work in assigning bulk petroleum to the services, Allies, and essential civilian users. He is now en route to Cairo as Navy petroleum attache for the State Department.

J. J. Allinson, vice president of J. A. Jones Construction Co. in charge of its petroleum engineering division, and **Gordon Granger,** division manager, have set up headquarters in the Scanlan Building in Houston.

Ernest H. Smith, drilling superintendent for Socony-Vacuum Oil Co., Inc., has left New York for Spain where he will supervise the drilling of a test well.

O. L. Fontenot, recently released Army captain, has rejoined Humble Oil & Refining Co. as senior civil engineer in the West Texas division. Other production department supervisory employes back with Humble after Army service include:

William B. Burklin, civil engineer in the East Texas division.

William A. Castille, assistant civil engineer in the Louisiana division.

Everett C. Clark, civil engineer in the Gulf Coast division.

Murray H. Cunningham, civil engineer in the Natchez district.

Nathaniel Ford, civil engineer in Houston.

F. S. Godbold, civil engineer in the Louisiana division.

Andrew M. Gruy, civil engineer in the Gulf Coast division.

Dudley J. Lewis, civil engineer in Houston.

H. E. Lott, civil engineer in Houston.

Eugene H. McCann, civil engineer in the Southwest Texas division.

J. U. Parker, civil engineer in the Southwest Texas division.

Charles M. Sherfesee, civil engineer in the East Texas division.

J. M. Spiller, civil engineer in the East Texas dvision.

John S. Toler, district civil engineer in the Louisiana division.

Wyatt G. Trainer, civil engineer in the Southwest Texas division.

Lloyd O. Zapp, supervising engineer in Houston.

Philip E. Barber, Jr., has returned to Humble as assistant division civil engineer in the Gulf Coast division. Others who have rejoined the company after service in the Navy include:

Richard C. Newsome, district civil engineer in the Louisiana division.

G. B. Randolph, district civil engineer in the Louisiana division.

Everett T. Shahan, civil engineer in the East Texas division.

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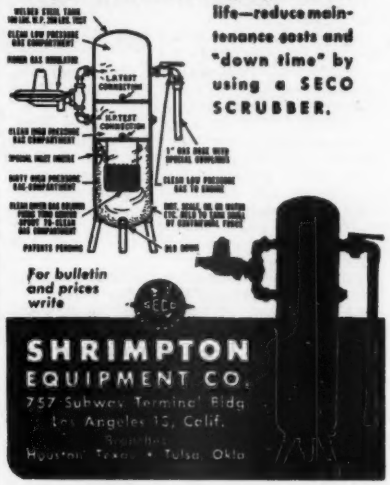

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CALENDAR

April

Southwestern Gas Measurement Short Course. Norman, Okla., April 23-25.

Oil Heat Institute of America, national oil heat exposition, Commercial Museum, Philadelphia, April 23-27.

A.P.I. directors' meeting, Blackstone Hotel, Fort Worth, April 28.

Texas Railroad Commission, flare gas elimination hearing for North Texas operators, April 28, Fort Worth.

Independent Petroleum Association of America, midyear meeting, Houston, April 29-May 1.

May

Houston Nomads, River Oaks Country Club, May 7.

Pennsylvania Gas Association, Galen Hall Wernersville, Pa., May 7-9.

Natural Gas Department, American Gas Association, annual spring meeting, Hotel Gibson, Cincinnati, May 7-8.

National Association of Corrosion Engineers, annual meeting, President Hotel, Kansas City, Mo., May 7-9.

Petroleum Industry Electrical Association and Petroleum Electrical Supply Association, eighteenth annual joint conference, Mayo Hotel, Tulsa, May 7-9.

Los Angeles Nomads, Mayfair Hotel, Los Angeles, May 8.

Indiana Gas Association, annual meeting, French Lick Springs, Ind., May 9-10.

A.P.I. division of production, Southwestern district meeting, Washington - Youree Hotel, Shreveport, May 17-18.

National Oil Scouts and Landmen's Association, Jackson, Miss., May 23-25.

June

Society of Automotive Engineers, semi-annual meeting, French Lick, Ind., June 2-7.

Houston Nomads, River Oaks Country Club, June 4.

Pennsylvania Oil Producers Association, Bradford district, fifteenth annual meeting, Pennhills Club, Bradford, Pa, June 6.

A. P. I. division of production, Mid-Continent district meeting, Skirvin Hotel, Oklahoma City, June 6-7.

Kentucky Oil and Gas Association, annual meeting, Hotel Lafayette, Lexington, June 7-8.

Los Angeles Nomads, Mayfair Hotel, June 12.

A.P.I. division of production, spring meeting, William Penn Hotel, Pittsburgh, June 13-14.

Federal Power Commission hearing in the natural-gas industry investigation, Washington, June 17.

American Society for Testing Materials, annual meeting, Buffalo, June 24-28.

Pennsylvania Grade Crude Oil Association, twenty-third annual meeting, William Penn Hotel, Pittsburgh, June 27-28.

July

Houston Nomads, River Oaks Country Club, July 2.

Los Angeles Nomads, annual meeting and party, Mayfair Hotel, July 10.

August

Houston Nomads, River Oaks Country Club, August 6.

American Institute of Chemical Engineers, western convention, Palace Hotel, San Francisco, August 25-28.

September

Houston Nomads, River Oaks Country Club, September 3.

Los Angeles Nomads, Mayfair Hotel, September 11.

National instrument conference, sponsored by Instrument Society of America, William Penn Hotel, Pittsburgh, September 16-20.

National Petroleum Association, forty-fourth annual meeting, Hotel Traymore, Atlantic City, N. J., September 18-20.

October

Houston Nomads, River Oaks Country Club, October 8.

American Gas Association, annual convention, week of October 7, Atlantic City, N. J.

American Gas Association, annual meeting, Atlantic City, October 7-12.

Los Angeles Nomads, Mayfair Hotel, October 9.

Texas Mid-Continent Oil and Gas Association, Rice Hotel, Houston, October 16-18.

November

Houston Nomads, River Oaks Country Club, November 5.

Society of Automotive Engineers, national fuels and lubricants meeting, Mayo Hotel, Tulsa, November 7-8.

A.P.I. annual meeting, Stevens Hotel, Chicago, November 11-14.

Los Angeles Nomads, Mayfair Hotel, November 13.

December

American Society of Mechanical Engineers, New York, December 2-6.

Houston Nomads, River Oaks Country Club, December 3.

Los Angeles Nomads, Mayfair Hotel, December 11.

1947

January

Society of Automotive Engineers, annual meeting and engineering display, Book-Cadillac Hotel, Detroit, January 6-10.

May

International Petroleum Exposition, Tulsa. May 17-24.

Rocky Mountain Area

(Continued from page 188)

running pipe, a drill-stem test from 3,345-65 ft. recovered 1,930,000 cu. ft. of gas and 150 ft. of water in 30 minutes. Another from 3,332-45 ft. recovered 2,444,000 cu. ft. of gas in 45 minutes, no water.

Deeper pay at Cat Creek.—Indications that the Ellis sand in the Cat Creek field in Montana will be productive in the field proper are seen in Ralph Chamberlin 12-A Rhens, NE NE SE 9-15n-29e, located 5½ miles west of the new producing area on the east or Mosby Dome. This is an old well drilled deeper from 1,420 ft. to test the lower horizon. It topped the third Cat Creek sand, a normal water horizon, at 1,555 ft. The Ellis sand, topped at 1,740 ft., showed some oil in the cores, but water broke through from the upper sand. The 5½-in. was cemented at 1,739 ft., and the hole was drilled to 1,753 ft. After several squeeze jobs, the well looks like a producer, and is estimated at 50 bbl. per day.

New operations.—Twelve new operations were reported, of which four are in Colorado, four in Wyoming, and four in Montana. The Colorado operations included three wells in the Rangely field and a wildcat on the Yellowjacket structure in Rio Blanco County, 15 miles southeast of the Wilson Creek field, all by the Phillips Petroleum Co. The Yellowjacket test will be important as it will drill all horizons down to the Devonian at approximately 5,000 ft. It is located in NW SE SW 1-1n-92w, 3½ miles northwest of a well drilled several years ago which went to the Madison and had several shows. The ground elevation is 9,213 ft., probably the highest in the Rocky Mountain area. A road was built last fall. The structure is unitized with 12,600 acres in the unit.

Wyoming operations include three development wells, one each in Big Muddy, East Lance Creek, and Lance Creek, all by Continental Oil Co., and a wildcat on the Lysite structure in Fremont County in Sinclair-Wyoming Oil Co. 1 Lysite Unit, NE NE NW 35-39n-91w. The last named will be an interesting test as it is located in an area which has attracted much attention in former years. There are a number of oil seeps in a canyon in the southern part of Township 40 north, ranges 90 and 91 west, where outcrops of the Embar, Tensleep, and other formations down to the granite may be examined. These seeps are believed to have their origin in the Deadwood formation. A test was drilled as far back as 1912, but found an overlap of Tertiary beds and did not reach the objectives. In 1944, Ohio Oil Co. drilled 3 miles northwest of the Sinclair location, found a similar condition, and although several good shows were encountered, the hole was abandoned at 2,500 ft. without yielding much geological information, or reaching the objectives.

New Montana operations include a development well in the Cedar Creek gas field, another test for The Texas Co. in the Utopia district in Liberty County, and two locations by Northern Ordnance, Inc. in the Gage field. During the war Northern Ordance drilled a number of wells to the Amsden at 6,000 ft., and had a small production in six of these with a potential of 200 bbl. per day.

Completions.—Sixteen wells were completed, of which 12 were oil wells, with initial production of 1,807 bbl.; 2 were gas wells and 2 were dry holes. Three wells for 1,507 bbl. initial were in the Rangely field in Colorado. Wyoming, for the second week in succession, reported no completions. Montana had 12 completions, of which 9 were oil wells for 300 bbl., one was a gas well and 2 were dry holes. Fulcher Basin, northwestern New Mexico, had one small gas well.

MONTANA SUCCESSFUL WILDCAT

Cat Creek, Petroleum County: Ralph Chamberlin 12-A Rhens, NE NE SE 9-15n-29e, TD 1,753 ft., 5½-in. 1,739 ft., est. 50 bbl. per day from Ellis sand topped at 1,740 ft., old well deepened from 1,420 ft. to test lower horizon.

MONTANA WILDCAT FAILURE

North Cut Bank, Glacier County: Pattie-Stewart-Inland 1 Downing, C SW SW 30-37n-5w, TD 3,510 ft., water in Madison, top at 3,500 ft., ele. 4,077 ft., loc. 2 miles north Carter Oil Co. Madison discovery.

Kansas Fields

(Continued from page 195)

Rooks County: Bird & Boering et al 1 Veverka Estate, S/2 SW SW 27-8-19w, 2,549 bbl. from Arbuckle at 3,404-409 ft., TD 3,409 ft.

Atlantic Refining Co. 1 Carmichael, SE SE NE 16-9-17w, 37 bbl. from Lansing-Kansas City at 3,429-35 ft., TD 3,547 ft.

KANSAS WILDCAT FAILURES

Harper County: Lion Oil Co. 1 Reed, SE NW NW 3-33-8w, dry at 5,165 ft., Arbuckle 5,086 ft.

Phillips County: Helmerich & Payne 1 Baird, NE NE NE 8-4-19w, dry at 3,965 ft., Granite Wash 3,938 ft.

Rooks County: Tom Palmer 1 O. R. Henderson, NE NE NE 34-7-19w, dry at 3,342 ft., Arbuckle 3,302 ft.

Oklahoma Fields

(Continued from page 194)

SW SW SE 23-8n-10e, 216 bbl. at 3,405-35 ft., TD 3,435 ft., Cromwell 3,397 ft.

OKLAHOMA WILDCAT FAILURES

Jefferson County: J. S. Bridwell 1 Barett, SW SW NE 15-6s-6w, dry at 3,060 ft., limestone 3,049-60 ft.

Okfuskee County: C. W. Titus & Zephyr & Sunray 1-A Spaniard, SE SW SE 29-12n-8e, dry at 3,780 ft., Cromwell 3,761 ft.

Pawnee County: J. R. Porter 1 J. H. Potter, SW SW SW 24-21n-6e, dry at 3,010 ft., Mississippi lime 2,995 ft.

Equipment Men in the News

Spang-Chalfant Men Return From South America

Andrew L. Weigand and Dave C. Neely have returned from a 4-month tour of South American oil fields in the interests of Spang-Chalfant tubular products. Neely

A. L. WEIGAND

D. C. NEELY

is one of Spang's field engineers with headquarters in Houston, and Weigand is foreign representative with headquarters in New York.

G. A. Holloway to Dallas For Lee C. Moore

Transfer of G. A. Holloway from Wichita to Dallas has been announced by C. R. Krause, president of Lee C. Moore & Co., Inc. Holloway becomes district manager for the company with headquarters at Dallas. He formerly was district manager for Kansas. His association with the company covers a period of 17 years.

Hall Made Manager of Weatherford Plant

J. E. Hall, Jr., has been appointed manager of the Weatherford plant of Weatherford Spring Co., manufacturers of wall-cleaning scratchers, centralizers, and other oil-well completion equipment and tools. Hall was employed by Superior Oil Co. for 4 years in California and Louisiana and spent a short time with Weatherford Spring prior to entering the armed forces.

Harry E. Smith, Vice President In New Corporation Post

Sumner Simpson, president of Raybestos-Manhattan, Inc., announces that Harry E. Smith of the Manhattan division, Passaic, N. J., corporation vice president, will be in complete charge of corporation rubber product sales and marketing.

Warner Heads Larkin California Sales

C. F. "Cliff" Warner was appointed California sales representative and will devote his entire time to the sales and servicing of Larkin Packer Co.'s line in California. Warner has had 22 years' experience in the cementing business. He started with Perkin's Cementing Co. in 1923 and was promoted to district manager 5 years later and again to field manager in 1938—a position which he held until the company was sold in 1940. In the latter part of this same year he became employed by International Cementers, Inc., and was promoted to district manager a year later—a position he held until his recent resignation.

Turner Establishes Office as Manufacturers' Agent

Tom Lawrence Turner, recently resigned as manager of the American Iron & Machine Works Co., Houston branch, has established offices in Houston to serve the Mid-Continent oil area as a manufacturers' agent. For the past 16 years he has been directly connected with the drilling, producing and pipe line phases of the industry. His agency represents Gorman-Rupp Co. of Mansfield, Ohio; King Oil Tools, Houston; General Welding Works, Houston, and Oil Field Machine & Supply Co. His offices are located at 531-532 Neils Esperson Building, Houston.

Spahr Heads Advertising For Jessop Steel Co.

Wayne R. Spahr has been appointed advertising manager for Jessop Steel Co., Washington, Pa. He has been associated with Jessop for the past 11 years in various departments, including production, cost, and advertising. He continues as editor of "The Top Notcher."

Oil Base, Inc., Appoints Two New Field Men

Thad Randolph and Jack Long, both recently discharged from the Navy, are now associated with Oil Base, Inc., stationed in the Mid-Continent area with headquarters in Tulsa.

Hammel-Dahl Co. Appoints Milham

Hammel-Dahl Co., Providence, R. I., designers and manufacturers of automatic control equipment, announces the appointment of Russell Milham as district sales engineer, in charge of the Chicago and Midwest district. Milham joined the Hammel-Dahl sales department in 1943, and later, for several years, was instrument engineer and chemist at E. B. Badger & Sons and Colonial Beacon Oil Co. His address is 447 Monadnock Building, 53 West Jackson Boulevard, Chicago.

Dallas Office Opened By Fawick Airflex

Fawick Airflex Co., Cleveland, announces opening of a sales and service office at 2509 Commerce Street, Dallas. Manager of this office is John V. Eakin, who for the past 2 years has been clutch service manager at the Fawick plant in Cleveland. Eakin spent several years with National Supply Co. in Oklahoma and in Toledo, Ohio.

Layden Goes to New Post

Elmer F. Layden, who has resigned his position as commissioner of professional football, National Football League, has been appointed assistant to the president of Shippers' Car Line Corp., and will be temporarily assigned to the corporation's Chicago office. Shippers' Car Line, with headquarters at 30 Church Street, New York City, a subsidiary of American Car & Foundry Co., operates one of the nation's largest fleets of railroad tank cars as well as other special types of railroad cars.

Tubbs Cordage Executive Manila Bound

Herman D. Nichols, vice president of Tubbs Cordage Co., sailed last month for Manila, P. I., to assist in carrying on the rehabilitation of Philippine cordage properties. Among other cordage executives sailing with Nichols were C. A. Carter, vice president of the company.

Brooks Names Peters Acting Sales Manager

E. N. Brooks, president of Brooks Equipment & Mfg. Co., Knoxville, announces appointment of John W. Peters, sales representative, as acting sales manager, replacing R. S. Tucker, who has resigned. H. H.

Newly elected officers of the New York Chapter of Nomads are shown here. They are, seated: Val R. Wittich, regent; John H. Baird, president; David J. Muldoon, treasurer, and William J. Campbell, regent. Standing: James W. Reed, secretary; George W. Knight, assistant sergeant-at-arms; Ben A. Hilliard, sergeant-at-arms; Edmund F. Gahan, assistant treasurer; Kenneth J. Langley, assistant secretary. Ralston M. Dinges, vice president, is not in picture

Houston, Jr., will be in charge of sales promotion for the manufacturing division of the company.

Graver Names General Manager And Plant Superintendent

Graver Tank & Manufacturing Co., Inc., East Chicago, Ind., announces the appointment of H. G. Sharp as general manager. Sharp goes to Graver from General Machinery Ordnance Corp. where he was pro-

H. G. SHARP

W. G. SHIPMAN

duction manager and later assistant general manager. He has also been associated with Cyclops Steel Co. of Titusville, Pa.; Transue & Williams Forging Corp. of Alliance, Ohio, and Hollow Steel Propeller Division of the Curtiss-Wright Corp.

William G. Shipman has recently been appointed by Graver as plant superintendent at East Chicago. As engineer and plant manager he was associated with Babcock & Wilcox for a period of 10 years and later with Allied Chemical Corp. on steel plate work. His other plant supervisory experience includes 2-year periods each with Firestone Tire & Rubber Corp. and General Motors Corp.

Dougherty Sales Representative For Robinson Packer Co.

C. F. DOUGHERTY

Charles F. Dougherty has been appointed special sales representative for Robinson Packer Co., according to an announcement by Jarrett M. Woods, vice president and general manager at Tulsa. Sales office and store of Robinson Packer are in Tulsa where Dougherty will make his headquarters, and factory at Coffeyville, Kans.

Wherry Heads L.P.G. Division

Appointment of Richard H. Wherry as chief engineer of the liquefied petroleum gas division, The Weatherford Co., Cleveland, has been announced by George H. Hufferd, vice president in charge of engineering.

Caterpillar Names Managers of Divisional Export Departments

H. B. Shawl, W. B. Pringle and N. M. Chrisman have been named divisional managers of Caterpillar Tractor Co. export department coincidental with the resumption of commercial export business, it is announced by J. Q. McDonald, export manager. Shawl will be in charge of export dealers in Australia, New Zealand, Hawaii, Fiji Islands, Netherlands Indies, Malaya, Philippines, Indo-China, Thailand, China, Japan, India, Burma, and the Near East, including Egypt. Pringle is divisional manager of export dealers in Europe, French, Spanish and Portuguese Africa, Nigeria, British East Africa, and South Africa, including adjacent islands. Chrisman becomes divisional manager in charge of dealers in Mexico, Central America, South America, and the West Indies. W. R. Morrissey will succeed Chrisman as export district representative in Mexico.

Manton Joins G. M. Diesel Oil-Field Staff

Fred L. Manton has joined the General Motors petroleum industry sales staff, according to Arch F. Campbell, manager of the petroleum industry sales office of the G. M. Detroit Diesel Engine Division.

Warner Goes to Atlanta For Ethyl Corp.

Stonewall Jackson Warner, Jr., who recently returned to his work with Ethyl Corp., has been appointed assistant manager of the Atlanta division of the corporation, President Earle W. Webb announced.

Climax to Handle Equipoise Controls Sales in Mid-Continent

Roy F. Coleman, of Equipoise Controls, New York, announces the appointment of Climax Industries, Inc., of Tulsa and Houston, to handle the sales for his firm in Texas, Oklahoma, Southern Kansas, Northern Arkansas and Southeast New Mexico.

Galeener Named to New Post by Homco

Houston Oil Field Material Co. announces appointment of Lynn H. Galeener as chief directional drilling engineer in charge of the company's directional drilling services. His experience includes 5 years' service with Houston Oil Field Material Co.; previously, he spent 4 years with Fullgage Tool Co.

Oil Industry Gets Air Service

Eagle Air Transport, with headquarters at Municipal Airport, Houston, began operations March 1, as a nonscheduled air service especially developed for the oil industry where speed is a prime factor in the moving of men and equipment to emergency, or unusually important jobs. The company offers overnight service from Houston to Los Angeles, with stops at Odessa and Tucson. A special service is also available to Mexico, Central and South America.

Durand Named Sales Manager Of Edward Valves, Inc.

R. A. DURAND

Raymond A. Durand, formerly assistant sales manager of Edward Valves, Inc., East Chicago, Ind., has been advanced to the position of sales manager, W. F. Crawford, president of the company, has announced. Durand has been a member of the Edward engineering sales organization for more than 9 years.

Lincoln Appoints Consulting Engineer

Lincoln Electric Co., Cleveland, announces appointment of R. H. Davies as consulting engineer in charge of the educational work. For the past 2½ years he has been the Lincoln representative in Washington, D. C., where he did consulting engineering work with the Army, Navy, and other government agencies.

Maloney-Crawford Elects New Officers

At a recent directors' meeting of Maloney-Crawford Tank & Manufacturing Co. the following officers were elected to serve for the ensuing year: H. D. Crawford, president and treasurer; O. W. Maloney, vice president; J. C. Highfill, vice president in charge of manufacturing; S. P. Wallace, vice president in charge of sales; J. P. Asbury, secretary.

Aireon Names Two

Arthur E. DesNoyers has been named director of procurement for Aireon Manufacturing Corp. by R. C. Walker, president. Russell J. Cole will continue as chief purchasing agent, and Daniel Wolfred has been appointed works manager.

In appreciation of his "thoughtful, friendly, and understanding leadership for more than 40 years," employes of Lufkin Foundry & Machine Co., Lufkin, Tex., presented President W. C. Trout a bronze plaque at a barbecue April 6 in celebration of his seventy-second birthday. In the photograph Trout is shown receiving the plaque from H. W. Ragland, veteran boilermaker who, on that day, celebrated 40 years of service with the company. Others in the picture are Dutch Oberpriller, Jess Belote, C. B. Ragland, and Al Cudlipp, vice president and sales manager, all veterans of from 25 to 40 years' service